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THE MAGAZINE OF APPLIED ENGINEERING

FEBRUARY 1957

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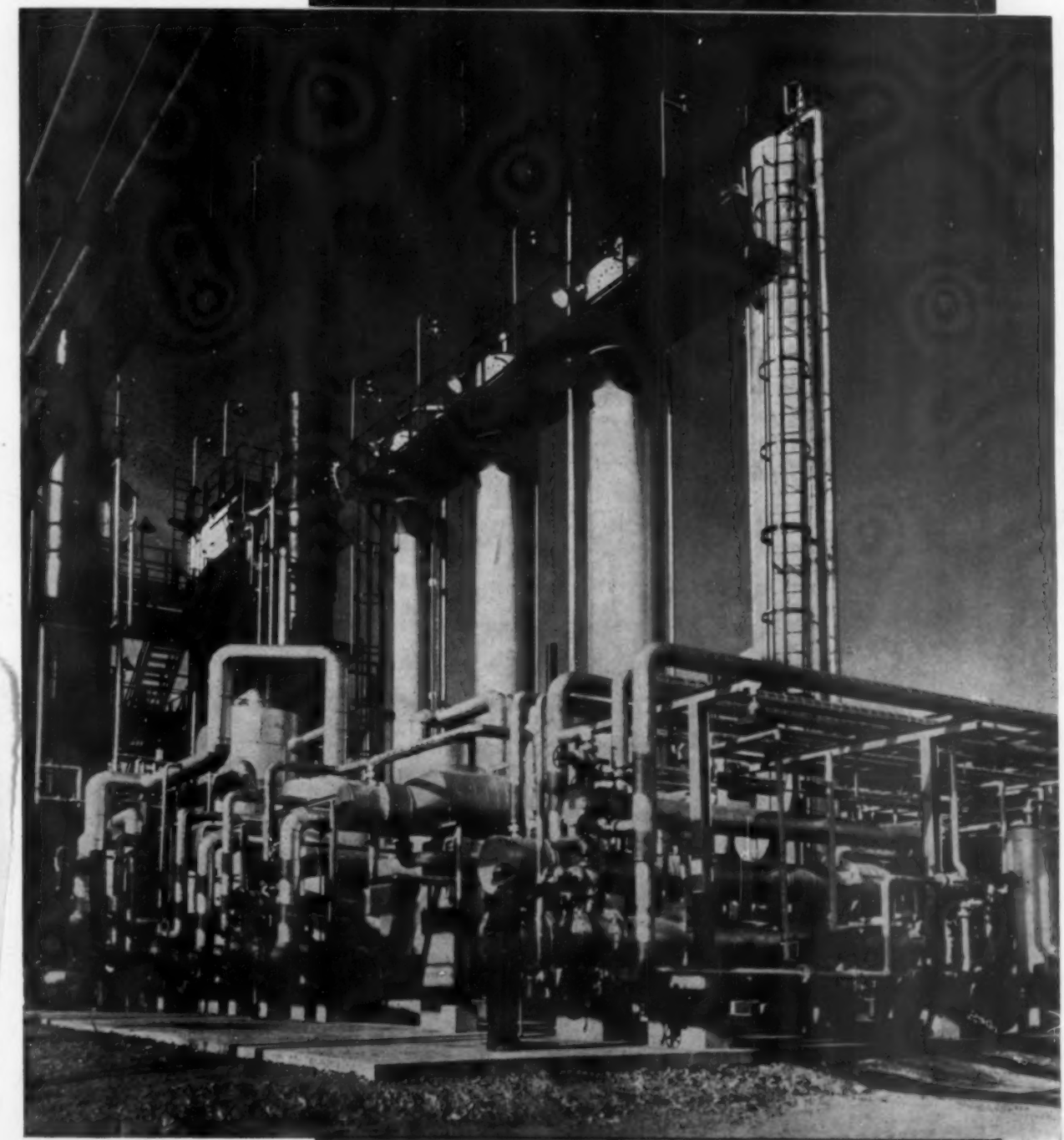

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See news story/page 134

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STate 2-1266

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MAdison 9-2681

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PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

FEBRUARY 1957 VOLUME III, NUMBER 2

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Letters to the Editor

Article

Highlights

Cutting and Trimming of Plastics with the Panel Saw. (p. 105)

Details on operation and applications of panel saws for trimming and sizing large plastic sheets. Advantages and disadvantages are discussed, and a comparison given with carbide-tipped blades and abrasive wheel cutters for plastics.

•

Functional Selection of Plastic Materials —Part I. (p. 108)

The significance and utilization of specific gravity, thermal insulation, and electrical insulation property values in selecting a material for a particular application are described and discussed. The beginning of a two-part article.

•

High-Pressure Teflon Seals and Closures. (p. 113)

Design and property data are given on Teflon packing rings for high-pressure pump valve seals, and self-sealing closures for high-pressure chemical reaction vessels.

•

Repairing Aluminum Castings with Metallic Resin Putty. (p. 116)

How metallic epoxy resin putty is used in a foundry to repair imperfect castings that are not destined for structural or mechanical uses. This method has replaced the aluminum solder repairing formerly used.

•

GFR Process for Fiberglass-Resin Low-Pressure Laminates. (p. 120)

Design, operation, and application data are given on a new process used to make laminate moldings to close thickness and resin-glass ratio tolerances.

Previews

The following articles will be published in the March issue:

Design for Better Calendering. Kendrick J. Gooch, asst. division engineer, Farrel-Birmingham Co., Inc., Ansonia, Conn.

Advances in Plastics for Automotive Body Manufacture. John G. Coffin, senior experimental engineer, Chevrolet Motor Division, General Motors Corp., Detroit, Mich.

Functional Selection of Plastic Materials —Part II. D. A. Dearle, plastics division manager, North & Judd Mfg. Co., New Britain, Conn.

Load-Deflection Properties of Glass-Reinforced Plastic Laminates Under Rapid Heating. J. H. Beno, E. F. Smith, and A. M. Dowell, technical staff, Plastics Dept., Hughes Aircraft Co., Culver City, Calif.

Copy of December Issue Wanted

Dear Sir:

In your December issue, you have an article describing the method of mixing polyester-glass resins. This article is of great value to us in regard to an inquiry we have.

We have not been able to locate a copy of this issue in Youngstown, and would appreciate it very much if you could forward same to us.

S. B. Sprague, Ch. Engineer,
Deltec, Inc.,
Youngstown, Ohio

(A complimentary copy of the December issue has been sent to Mr. Sprague. —Editor)

• • •

Sources of Styrofoam

Dear Sir:

Can you supply us with a list of manufacturers of Styrofoam or other wholesale sources of Styrofoam sheets or cut-outs suitable for Christmas decorations?

We are in the process of developing in 1957 a Christmas decorating package, and will appreciate any such information you can send us at an early date.

Mrs. E. W. Johns
The Otis Company
Wilmette, Ill.

(We have referred Mrs. Johns to Dow for further information. Can our readers offer any suggestions?—Editor)

• • •

Trademark Correction

Dear Sir:

In your December 1956 issue, you have an article, "Polymeric Adhesives for Glass," by Frank Moser.

This interesting article is very informative, but I would like to indicate a misuse of our trademark. This occurs on page 802 in Table 4, where the word "Thiokol" is used under 'Chemical Type.' A more correct naming would be "polysulfide rubber" or "polysulfide liquid polymers."

The word "Thiokol" is a registered trademark, number 273,383, for all the products manufactured by Thiokol Chemcial Corp. and, hence, is ambiguous in its meaning. It is not the name of any material and such generic use is, therefore, incorrect.

Because this generic use is occurring more frequently, and because such generic use can prove harmful to our trademark, we are taking this opportunity to call it to your attention and request that in the future, a more suitable term such as "polysulfide rubber" or "polysulfide liquid polymer" be used in place of the trademark "Thiokol."

F. O. Davis, Supervisor
Patent Section,
Thiokol Chemical Corp.
Trenton, New Jersey

(Our apologies to Thiokol for the improper use of their trademark. This must have been "the one that got away," since we try to use correct chemical terminology at all times.—Editor)

• • •

Address of Herculite

Dear Sir:

We have recently obtained a copy of the August 1956 issue which contained information on a vinyl-nylon hatch cover manufactured by Herculite Protective Fabrics. Unfortunately, the address of this company was not given, and we would be most appreciative if this were made available to us.

P. M. Reeves
Western Plastic Products
Vancouver, B. C., Canada

(Herculite's laminated hatch cover was described in the New Products department of the August issue, Reader Service Item P-4. Herculite's address is 140 Little St., Belleville, N. J.—Editor)

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation, and address.

A letter will not be printed if publication is not desired by the sender, and the identity of the writer will be withheld, if desired.

—The Editor

"Quote . . . Unquote"

Plastics in Packaging

"Plastics will play an ever-increasing role in 'hard goods' packaging. So far, plastics have made major inroads in what is broadly classified as 'hardware.' Actually, they have only touched the surface. Injection molding is a common method used in producing multi-unit hand tool packagings. This technique is good, but it will only grow in proportion to the development of lower tool costs, and the recognition that must be given to filling the packaging requirements of lower unit volume goods, seasonal items, and special combinations of merchandise.

"This technique of plastic packaging will find continued success in developing kit and multi-piece packaging, and in the packaging of precision tools or instruments where the re-use character of the package is of great importance. The development of new materials, such as low-pressure polyethylene, offers new fields of activity, broader applications, and promises more attractive costs to the user."

C. W. Harper, Manager,
Informative Packaging & Labeling Div.,
Sears, Roebuck & Co., Chicago, Ill.

• • •

Plastic Foams in Refrigerators

"Some success has been enjoyed in foaming the urethanes and styrenes in place onto the insulation side of molded or vacuum formed freezer door inner members. There is encouragement over the fact that rigid foams, foamed into this inner member, would permit the use of much thinner wall sections for these inner members.

"This would be a very desirable step toward reducing the cost differential between the present method and the proposal to foam insulation in place. Such a scheme applies not only to freezer doors, but also to the regular door on refrigerators. The contours of our inner doors make it almost impossible to fit the present insulating materials into these areas. Here, foamed-in-place insulation could assure good insulation and, if rigid, could permit economies via thinner skin sections.

"Another interesting and promising use for foamed insulation lies in its ability to serve as an insulating filler between two sandwiching skins of metal, plastic, or wood. The structural advantage of sandwich construction is widely recognized.

"These and many other applications offer almost unlimited possibilities for foamed plastic insulating materials."

O. H. Yoxsimer, Manager,
Refrigerator-Freezer Engineering,
Westinghouse Electric Corp.,
Columbus, Ohio

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DAPON resin is the *new prepolymer* of diallyl phthalate—a dry white powder with improved properties. It is *easy to handle and store.* Its advent has made possible the use of diallyl phthalate in *all processing methods* for thermosetting resins.

Because the cure of DAPON resin involves addition polymerization, and not condensation, *moisture formation is non-existent* during cure.

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Rid yourself of the moisture problem. Be assured of locked-in initial properties and locked out moisture. *Write now for technical literature containing properties, uses and methods of application for DAPON resin.*

Molding compounds containing DAPON resin are produced by Acme Resin Corporation, Durez Plastics Division, and Mesa Plastics Company.

OHIO-APEX DIVISION
Food Machinery and Chemical Corporation
Nitro, West Virginia
Department 15

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Admex 745 hasn't been around very long, but it already has won an enthusiastic bunch of friends. People involved in rotational castings and slush molding work are particularly fond of it.

One big reason why this epoxy type plasticizer has made so many friends in rotational casting is that it gives controlled gelation, making possible even distribution of plastisol on the interior walls of the mold.

Those who cast such items as balls, bulbs, and automotive parts like the lively, rubber-like resiliency which Admex 745 contributes. Its unusual viscosity depressing characteristics when used in plastisols will give a genuine economic advantage, too. By adding small amounts of Admex 745, summertime viscosity increases can be minimized and borderline material made usable.

Admex 745 also provides remarkable low temperature flexibility . . . a quality which brings joy to the hearts of cold weather footwear manufacturers, for example.

If you count pennies (a fine way to make dollars), keep in mind that Admex 745 actually costs much less than the price per pound would seem to indicate. Admex 745's low weight per gallon (specific gravity 0.900) makes it important that you calculate its price on a volume basis. Other pertinent specifications, include: Color (Gardner Holt '53) is 3 Max., acid value is 1.0 Max., and viscosity is 0.5 Stokes (Approx.).

It's possible to carry on this way about Admex 745 for pages. In fact, we have done just that in a new technical bulletin which you can have free for the asking. Just fill out the coupon below.

Admex 745
Low Temperature
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Archer-Daniels-Midland

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Archer-Daniels-Midland Company
Investors Building, Minneapolis 4, Minnesota

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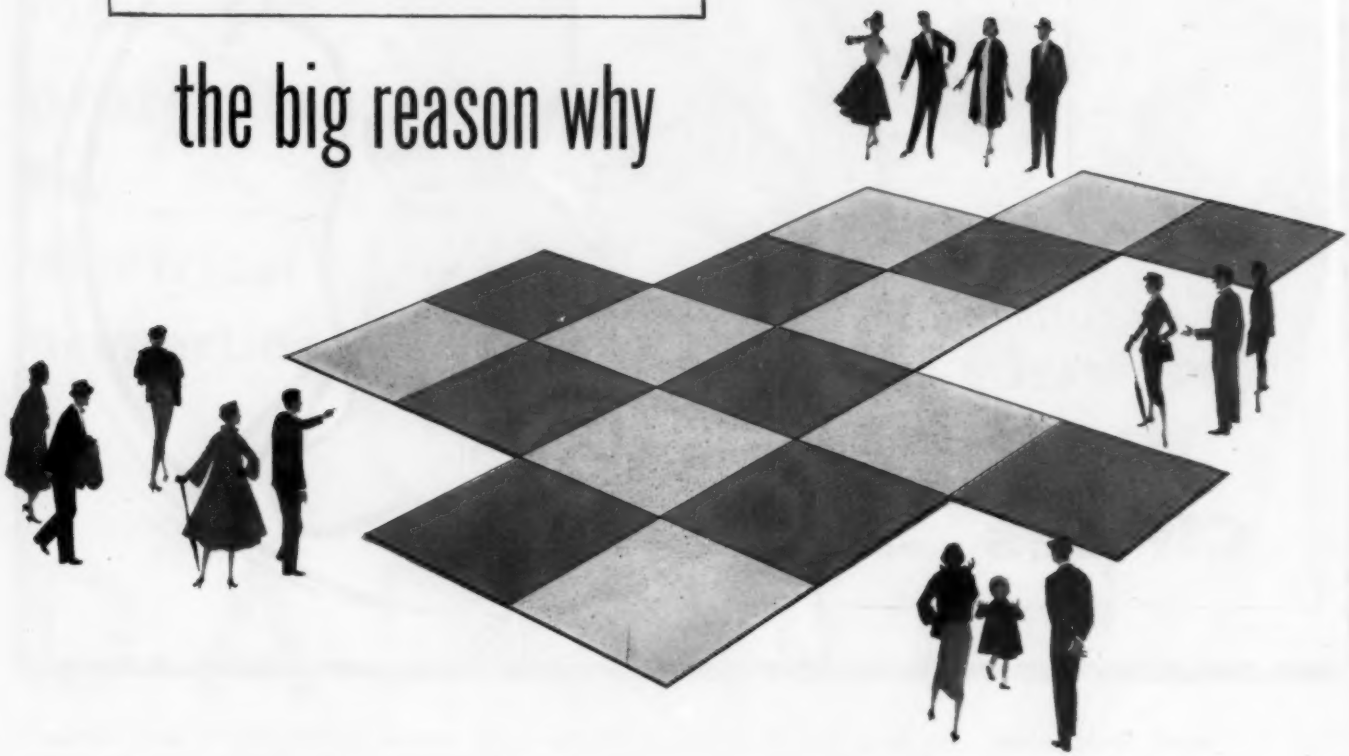

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It will pay you to investigate Plastolein 9720 Polymeric because it provides the extreme permanence and durability so vital to the life of your vinyl flooring. This results primarily from 9720's outstanding performance relating to such factors as dimensional stability, heat and light stability, volatility, and extraction.

Plastolein 9720 also offers these cost reducing advantages: low plasticizer cost, relatively high efficiency, low filler absorption, and the efficiencies of easy processing. Also, though 9720 is a polymeric, its relatively low viscosity permits the economies of bulk shipping and handling.

With all these advantages, why not try Plastolein 9720 in your vinyl tile formulations—or in any formulation where permanence is essential.

For complete details on 9720 or any of the Plastolein Plasticizers, mail coupon below:

Emery

Organic Chemical Sales Department

Emery Industries, Inc., Carew Tower, Cincinnati 2, Ohio

Emery Industries, Inc., Dept. PT2, Carew Tower, Cincinnati 2, Ohio

Please send 32-page Emeryfacts describing all the Plastolein Plasticizers.

Name.....Title.....

Company.....

Address.....

City.....State.....

NEWS in BRIEF

Plastics misapplications can be avoided by molder honesty and the education of user engineers, says Paul E. Fina, director of sales engineering for Fiberite Corp. (see guest editorial, page 115). He suggests the publication of an annually-revised handbook that would include a system for the proper selection of plastic materials for general and specific applications; a description of the properties of the different plastics; a comparative evaluation of materials according to their end-properties; and design data on materials based on grouped physical properties.

New, direct oxidation process, whereby various aromatics are simply oxidized with air to the respective dibasic acids, has been developed by Scientific Design Co. and its affiliates. Acquired by Standard Oil of Indiana, the process will be used to make phthalic anhydride, isophthalic acid, terephthalic acid, dimethyl terephthalate, dimethyl isophthalate, and benzoic acid to use as intermediates in the manufacture of alkyds, polyesters, elastomers, foams, plasticizers, films,and fibers.

Company developments of a varied nature are described in this issue. Manufacturing rights to G-E's Glyptal alkyd resins were purchased by Archer-Daniels-Midland. A new forest products research group has been set up by Borden to develop new resins and polymer products. Monsanto is setting up a special products department at Everett, Mass. Monsanto also entered into a distributorship agreement with Plax to market the latter's Polyflex 100 series film and sheeting of biaxially-oriented styrene. Portco purchased the plastic pipe division of Simpson Logging for incorporation into its own paper and plastic work.

Company expansions are in the news again after the year-end lull. Borden will triple the capacity of its newly-activated PVC resin plant at Leominster, Mass., and erect a new lab-office building adjacent to this plant. A new acrylic ester plant is under construction by Celanese at Pampa, Tex. Commercial production has begun at Escambia's new PVC resins plant near Pensacola, Fla. Goodyear opened a fully-equipped radiation lab in Akron, O. A new stabilizers plant will be built by Metal & Thermit near Carrollton, Ky. Narmco is completing a plant addition at Costa Mesa, Calif., to increase output of structural adhesives and laminating materials. National Aniline has started up its new isocyanates plant in Moundsville, W. Va. The Niagara Falls, N. Y., plant of Pathfinder Chemical, a Goodyear subsidiary, is being enlarged. The new Warren, Pa., plastics plant of Sylvania is in operation.

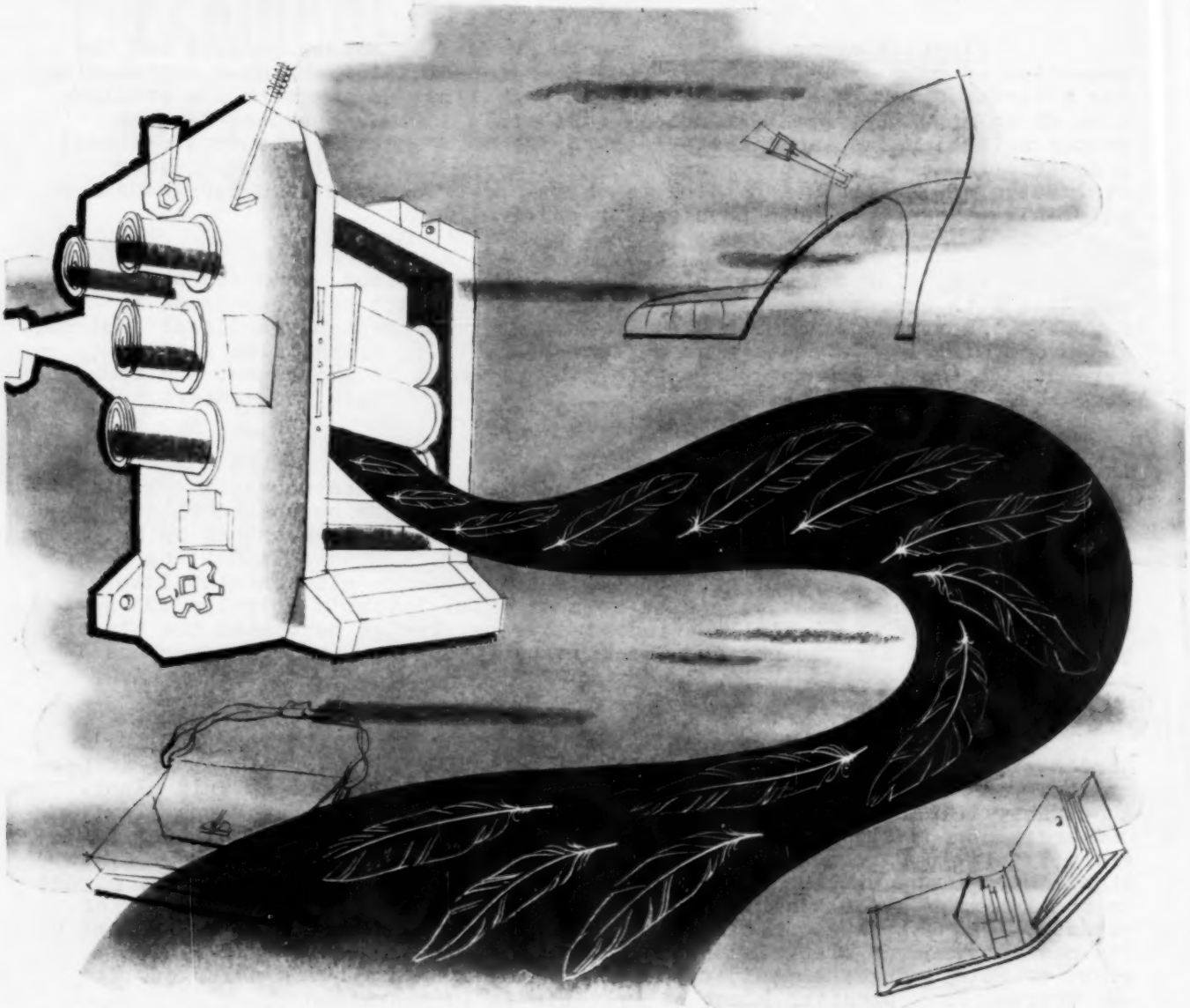
New Materials to be noted (see pages 144-5): gel-form release agent for epoxy resin castings; multi-purpose resin-base adhesives; ammonia-free phenolic molding compound for electrical applications; heat and light stabilizer for clear vinyls; polyester for making flexible urethane foams; easy-processing polymeric plasticizer for vinyls and cellulosics; and phthalate-ester plasticizer for extruded vinyls and slush-dip moldings.

New Equipment of special interest (see pages 146-9): carbide-tipped saw blades and router bits; environmental test chamber; combination folder and creaser for plastic sheets; vertical, hydraulic, compression molding press; roll winder for use with extruded film take-ups; glass-lined spray-rinse valves for reaction vessels; and two compression mold base assemblies.

New Products worthy of mention (see pages 150-2): flexible plastic laminate for kitchen countertops, backsplash areas, etc.; molded urea-housed intercom set for home and office use; school seat padding of vinyl foam with embossed vinyl covering; heat-sealable,clear polyester film; children's sports car of glass-reinforced polyester; molded fuse holders of glass-reinforced alkyd; three-dimensional, preprinted, vacuum-formed acetate window signs and displays; and fire-resistant, modified phenolic laminate.

VYGEN PVC RESIN

Ideal for stylish, light embossing



The trend toward light-embossed vinyl sheeting for fashion items could create serious production problems in your plant. Light-embossing on sheets calendered of ordinary vinyl resin often causes lumps and troublesome surface imperfections. You can eliminate those profit-wrecking problems with VYGEN® PVC resins. VYGEN PVC resins have excellent heat stability during processing (prevents color variations), closely-controlled molecular weight (assures processing uniformity), and a very uniform rate of solvation (minimizes surface imperfections).

Be sure you can supply the high-quality, light-embossed vinyl sheeting required for handbags, shoes, novelties and other uses — be sure you use VYGEN PVC resins. For more detailed information on the VYGEN resin to use in your operation, write to *The General Tire & Rubber Company, Chemical Div.*

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CHEMICAL DIVISION • AKRON, OHIO

Chemical Division GENERAL THE GENERAL TIRE & RUBBER CO. VYGEN

PLASTICS TECHNOLOGY

FEBRUARY, 1957

EDITORIAL: Guest Editorials Invited

A standard feature of PLASTICS TECHNOLOGY since its inception has been the monthly guest editorial contributed by company spokesmen or other individuals in the plastics industry.

Some of our guest editorials to date have been entirely unsolicited—in fact, even unexpected. Others have been contributed at our express invitation to the authors that they enlarge or expand on comments they had made previously in letters.

In line with the editorial changes and improvements made or planned in the magazine this year, we would like to discuss the functions of our guest editorials, and invite their contribution from our readers.

•

We look upon the guest editorials as providing a sounding board whereby any responsible person in the plastics industry, speaking either for himself or on behalf of his company, can express any thoughts or opinions that he considers worthy of attention and further publicity by our readership.

Interest to the readers is the only requirement. While the guest editorial can be on any subject, technical or non-technical, it should be borne in mind that our readers are essentially technical in nature by virtue of education and/or training. As such, the subject of the guest editorial should have special meaning or significance to these readers.

An important point to be emphasized is that guest editorials are not subject to any censorship, expressed or implied, on our part. They are edited only for grammar, punctuation, sentence structure, etc., designed to help the author present his viewpoint as clearly and as forcefully as possible. This, whether we agree with his viewpoint or not!

If in the course of this editing we come across a statement that could prove detrimental to the author, his company, or any other firm or segment of the industry, we will so inform the author and suggest a remedial change. This change is only a suggestion, and will not be made in the final printed version unless first approved by the author. If the suggested change is not approved, the original wording will be retained. In other words, all editing performed is done to best serve the author's interests.

Finally, the guest editorial can range from 750 to 1,500 words in length. When published, it is accompanied by the name, title, company affiliation, and photograph of the author.

•

We invite you, our readers, to prepare guest editorials for publication in the magazine. The only request we make is that we be advised of the subject and expected date of availability of your proposed guest editorial. This information will help resolve any conflicts in subjects, and permit early publication of your guest editorial when it is received.

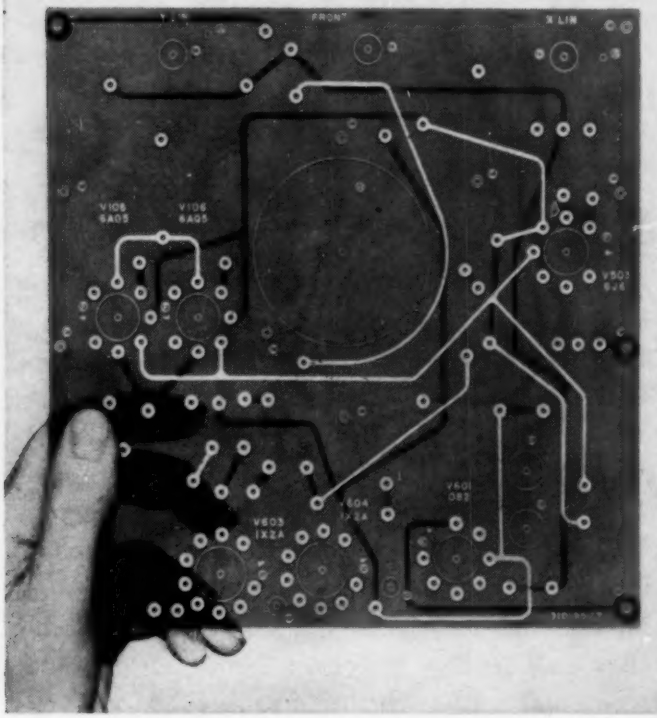
The rest is up to you!

Arthur M. Merrill

Editor

Below . . . No problem with electrical properties when your printed circuits are based on XXXP laminates made with RCI PLYOPHENS 5027 and 5036.

Photos courtesy of The Formica Company



***Above* . . . You cut treating machine time when filler sheets for high pressure decorative laminates are made with RCI PLYOPHEN 5573.**

***Left* . . . You reduce stock losses when you use PLYOPHEN 328 for binding fibrous glass or mineral wool into insulation batts. And P-328's low alkalinity definitely improves the water resistance of the insulation.**

fast cures and sure results...

when you use RCI liquid phenolic resins . . . job-designed for your laminating and bonding needs.

Reichhold has a PLYOPHEN liquid phenolic tailored to your exact need . . . whether the resin is going into the manufacture of printed circuits, into a binder for fibrous glass or mineral wool insulation, into filler sheets for decorative laminates, or any one of scores of other products.

PLYOPHENS are *job-designed* to assure fast production *and* uniform results. RCI controls quality all the way . . . right from the beginning, by producing its own phenol and formaldehyde.

Write us the details of your phenolic resin application and ask for a *sample* of the RCI liquid phenolic that will do the job best. Then try it out and see if you don't get superior results.

Creative Chemistry . . .
Your Partner in Progress

RCI

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Synthetic Resins • Chemical Colors • Industrial Adhesives • Plasticizers
Phenol • Formaldehyde • Glycerine • Phthalic Anhydride
Maleic Anhydride • Sodium Sulfite • Pentaerythritol • Pentachlorophenol

REICHHOLD CHEMICALS, INC., RCI BUILDING, WHITE PLAINS, N. Y.

PLASTICS TECHNOLOGY

Cutting and Trimming of Plastics with the Panel Saw

The first of a series of articles on current techniques and equipment for cutting and trimming of plastics.

R. W. HENDRICK, *President*
Hendrick Manufacturing Corp.
Marblehead, Mass.

Robert W. Hendrick was born in Boston, Mass., in 1913. He attended Cushing Academy and the University of Vermont, receiving a B.S. from the latter in 1931. In 1935, he formed a company, Seacraft, to design and build nautical accessories from mahogany. His career was interrupted for three years by naval service during the war. After selling Seacraft in 1952, he founded his present firm, which was incorporated in 1953. Mr. Hendrick has held his present position since the founding of Hendrick Mfg. Corp.

He is active as a member of SPI and the National Society of Plastic Fabricators; the latter organization is interested chiefly in plastic countertops and other store fixtures. Mr. & Mrs. Hendrick have no children, and reside currently in Marblehead, Mass.

THE trimming and sizing of large sheets of acrylic, PVC, and other thermoplastics, as well as phenolic, melamine, and glass-reinforced polyester plastics, can be done to advantage with a panel saw. This equipment is designed with overhead rails supporting a movable saw carriage. The saw is drawn through the stationary stock (the latter is never in motion during the cutting operation).

The panel saw is capable of producing a straighter cut than the conventional table saw because the blade is guided on the precision ground rails along the entire length of the cutting pass. The table saw is guided along only the length of its fence (about 30 inches); as the stock is pushed across the table saw, it may drift away from the fence.

The panel saw produces a cleaner cut than the table saw because the blade runs true in the kerf of the cutting table and the stock is supported at the point of cutting. This eliminates any shattering of brittle stock due to vibration. Glass fibers are chopped off cleanly when thus supported. The removable dado insert of the table saw does not provide such support because the blade must not touch the slot in the insert.

An additional advantage of the panel saw is that it

Table 1. Comparison of Carbide-Tipped Blades and Abrasive Wheels.

Carbide-Tipped Blades	Abrasive Wheels
(1) Produce larger, heavier chips with minimum dust.	(1) When run dry, produce objectionable, fine glass dust.
(2) Cut rapidly and very accurately but not as cleanly as abrasive wheels unless fibers are supported at the point of cutting. Give high production when sharp.	(2) Make slower and cleaner cuts. The side of the wheel buffs off the stringy glass fibers.
(3) Subject to frequent sharpening.	(3) When properly selected, wheels break down to continually present sharp cutting faces of the abrasive.
(4) Require higher initial investment. As a method, presupposes the availability of stand-by blades for sustained production schedules.	(4) Are inexpensive and expendable, but not necessarily more economical than carbide-tipped blades because of frequent replacement.

requires much less shop space than the table saw. To cut an eight-foot panel, the panel saw occupies only 11 feet of space, whereas a table saw requires 16 feet of cleared floor space (eight feet ahead of the blade, and eight feet behind the blade).

There are differences, of course, in cutting the various types of plastics, and each cutting application should be made only after proper consideration of information imparted by the blade manufacturers. We know, for example, that thermoplastic boards such as PVC have a tendency to fuse the cuttings, and require a blade with fewer teeth and deeper gullets than would be recommended for acrylics and phenolics.

Many of our customers use a carbide-tipped blade for cutting glass-reinforced polyesters, while others prefer to use an abrasive wheel, either wet or dry. The cutting of reinforced-plastic sheet containing a high concentration of glass presents many problems, and is one of the most difficult operations in the industry because the stock is very debilitating to both carbide-tipped blades and abrasive wheels. A comparison of these is given in Table 1.

Panel Saw Cutting

The inconvenience of repetitively trimming and cutting large sheets of stock is greatly reduced by use of a panel saw. With this equipment, the entire length or width of the sheet can be trimmed in one pass. Pressed and molded sheet plastics having irregular edges are particularly well trimmed to commercial sizes with a panel saw, with minimum loss of material from gauging inaccuracies.

In many cases, two or more panel saws are used in combination for sheet cutting or trimming. The number of saws used is based on the specific production requirements involved. Since manual handling of the sheets is costly, such multiple trimming often is desirable. Two currently used methods of multiple trimming involving the use of two and four panel saws are shown in Figure 1. Naturally, the four-saw set-up provides for greater production of trimmed sheets.

For multiple trimming, the pairs of panel saws usually are mounted with one saw as a rolling base whose distance from the other saw is adjustable to allow for necessary variations in dimensions of the sheets. Other methods of mounting multiple panel saws incorporate a rolling table to accomplish the desired flexibility in sheet sizes.

Simultaneous trimming of two or more sheets, using either single or multiple panel saws, is often performed on all types of plastics. In my opinion, however, simultaneous trimming offers a very small saving in time over the trimming of individual sheets. Individual sheets can be gauged to clear all irregularities by proper positioning of the sheet on the cutting table prior to trimming.

With simultaneous trimming of a stack of sheets, the stack must be so positioned on the cutting table as to arrange for removal of the deepest irregularity (in

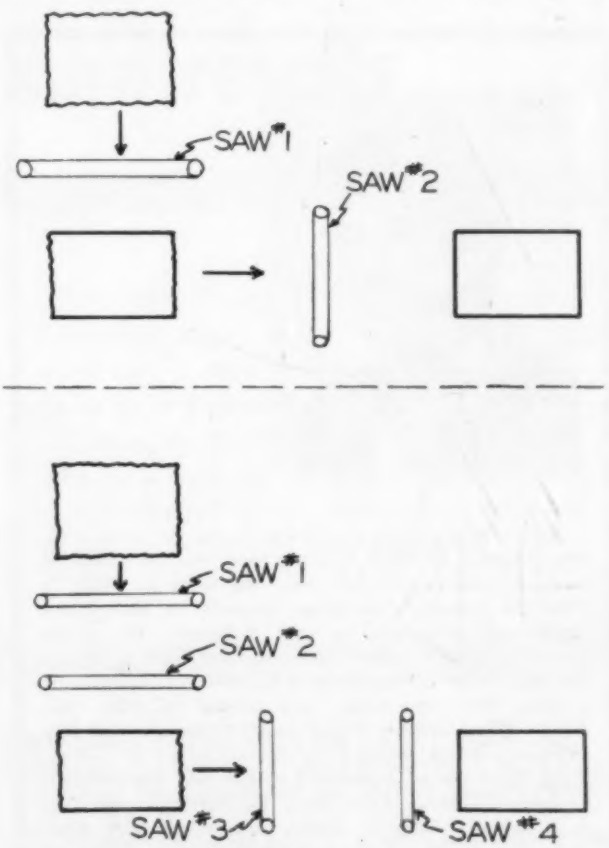

Fig. 1. Multiple trimming set-ups in current use with two (above) and four (below) panel saws. In the four-saw set-up, the saws operate simultaneously in pairs.

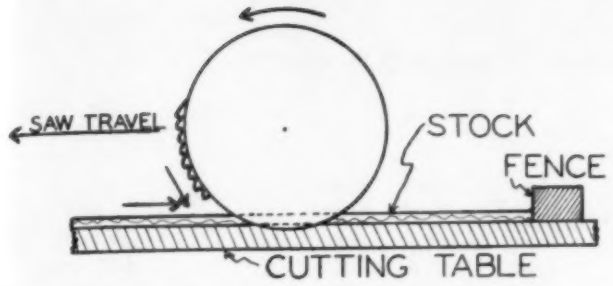

Fig. 2. Diagrammatic view of "climb" cutting. Arrows at lower left of blade indicate directions of thrusts imparted to stock.

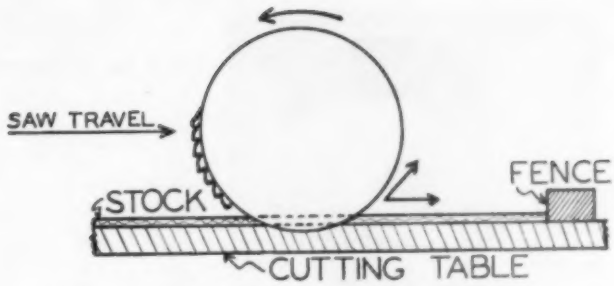

Fig. 3. Diagrammatic view of "up" cutting. Arrows at lower right of blade indicate directions of thrusts imparted to stock.

distance from edge of the sheet) in the stack. This, of course, can result in excessive waste of sheet stock by trimming sheets which might otherwise be left wider. Furthermore, each sheet in the stack must be positioned accurately against the stock gauge on the saw cutting table, thus providing another possible source of human error. Finally, each sheet in the stack often must be handled individually, even though the trimming operation is simultaneous.

"Climb" Cutting

The conventional method of cutting with a panel saw is to retract the saw carriage after each pass and, after re-setting the stock, perform the next cut. The blade usually is rotated in a "climb" cut direction (see Figure 2) which carries the cuttings downward. The blade teeth impart a downward and a lateral force to the stock being cut. This lateral force is applied in the opposite direction to the saw travel, and is absorbed by the fence placed at the starting end of the cut.

This method of cutting is particularly suitable for stringy materials such as plywood and glass-reinforced plastics because the saw kerf in the cutting table supports the stock on both sides of the cut, thereby eliminating all chipping. With glass-reinforced plastics sheets, the glass fibers tend to bend, rather than to part cleanly, when handled by conventional sawing methods. Since these fibers are firmly supported on both sides of the cutting table kerf, the panel saw will provide smooth, accurate cuts.

With "climb" cutting, a deeper blade setting increases the downward force on the stock, and tends to hold the stock tightly by the action of the blade teeth alone. Elaborate hold-downs for the stock are not necessary. If the stock has size and weight, and rests squarely against the fence, it almost requires no hold-downs whatsoever.

When the blade is set as shallow as possible, or just deep enough to part the stock, the teeth impart a raking action to the stock. Downward thrust is at a minimum, while lateral thrust is at a maximum. This latter thrust can be disregarded, since it is impossible for the stock to move farther toward the fence against which it rests.

It should be noted that there is some over-emphasis on the necessity for elaborate hold-downs when using panel saws for "climb" cutting. Under ordinary circumstances, a three-foot square stock sheet weighing five pounds or more does not require any hold-downs for "climb" cutting. However, the stock must bear firmly against the fence as close as possible to where the blade will enter. If this is not the case, the stock may twist and lock the blade. Stock which bears against the fence on both sides of the kerf, as in sizing cuts, will be more stable in the cutting operation than stock which rests against the fence on only one side of the kerf.

"Up" Cutting

With some plastic materials, it is possible to double the production rate by cutting on both passes. The return pass, when the blade is traveling toward the stock fence, is "up" cutting (see Figure 3). Cutting on both passes is generally suitable only for moderately thin stocks, up to about ½-inch in thickness, of certain plastic materials. Acrylics cut very well, as do some PVC's

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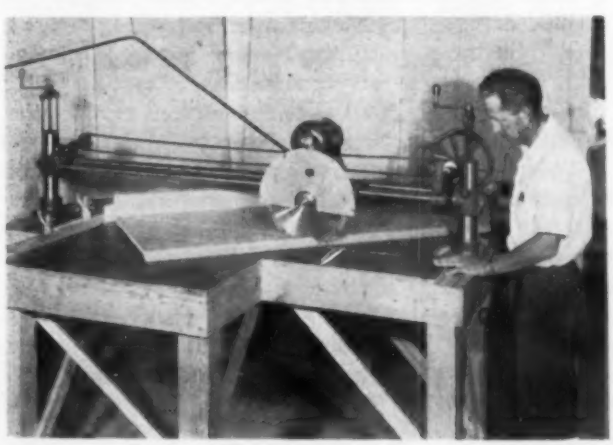


Photo courtesy: Paramount Commercial Studios

Fig. 4. Hendrick Model MLR (manual operation) panel saw.

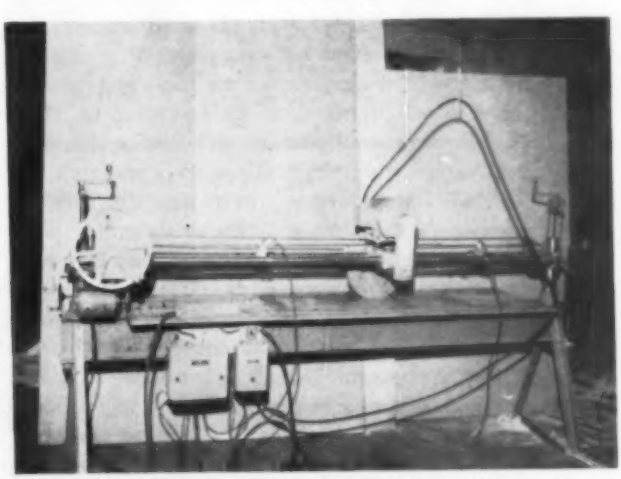


Fig. 5. Hendrick Model MA (manual/automatic) panel saw.

D. A. DEARLE, *Plastics Division Manager*
North & Judd Mfg. Co., New Britain, Conn.

Functional Selection of Plastic Materials—Part I

The beginning of a two-part discussion of material selection based on the physical properties and function of the molded part.

WHEN viewed in perspective, it becomes increasingly evident the World War II contributed more toward the improvement of the physical properties of the plastics than any other factor. The plastics industry had made tremendous strides prior to 1939, but after that year, new materials and new applications appeared so rapidly that physical property research was left far behind. Industrial uses were plentiful, but the actual behavior of the numerous materials under varying conditions was not too well known. Spurred on by the needs of the armed forces, physical research was given new impetus. Today, a great deal more is known of what to expect from most of the large array of materials than was apparent just 17 years ago.

No single plastic material possesses all the desired physical characteristics. If there were, there would be little need or use for any of the other plastics. However, different applications require the presence of certain qualities and the absence of others. For this reason, the plastics engineer, as well as the industrial designer, must know the physical properties of the available plastics. The layman, too, should possess at least some knowledge of the physical characteristics of the most important plastics.

The plastics technologist is primarily concerned with the functional selection of plastic materials. This choice is reflected in the innumerable industrial applications that are arising day after day. Provided with this fundamental knowledge of physical properties, it is the materials engineer's responsibility to specify the most suitable molded plastic. Such considerations as physical strength, relative weight, durability, and hardness, have to be weighed.

Resistance of the material to chemicals, moisture, and a wide range of atmospheric conditions has to be examined carefully before a decision is raechd. The

Table I. Comparative Physical Properties of Molded Plastics.

Material	Specific Gravity	Approx. Per Lb.	Cost, $ Per Cu. In.	Colors	Thermal Conductivity*	Heat Resistance, °F.	Dialect. Strength, Volts/Mil	Water Absorption**, %	Impact Strength, Ft. Lbs./In.
Phenolics: Woodflour	1.35	0.20	0.010	Bl. & Br.	4-7	300-350	200-445	0.3-0.8	0.24-0.34
Cotton flock	1.35	0.25	0.012	Bl. & Br.	4-7	275-325	240-350	0.4-1.5	0.32-0.50
Mineral	1.88	0.26	0.018	Bl. & Br.	8-16	350-450	150-350	0.1-0.3	0.20-0.40
Fabric	1.40	0.40	0.020	Bl. & Br.	4-7	250-275	200-400	0.4-1.5	2.0-4.0
Cord	1.40	0.45	0.023	Bl. & Br.	4-7	250-275	200-325	0.8-1.7	4.0-8.0
Rubber woodflour	1.30	0.29	0.014	Bl. & Br.	4-6	200-220	300-325	0.5-1.0	0.3-0.7
Silicone-glass fiber	1.70	2.75	0.168	Limited	3-4	400-500	175-200	0.4-0.5	3.0-15.0
Polyester-glass fiber	1.90	0.70	0.048	Limited	8-12	290-310	345-360	0.1-0.2	3.0-24.0
Urea-formaldehyde	1.48	0.33	0.018	All	7-10	160-180	300-400	0.5-0.7	0.25-0.35
Melamine-formaldehyde	1.48	0.50	0.027	All	7-10	240-260	350-400	0.1-0.6	0.25-0.35
Cellulose nitrate	1.37	F.N.A.	F.N.A.	All	5-6	130-150	350-550	1.0-2.0	5.0-7.0
Acetate	1.32	0.41	0.020	All	4-8	140-220	260-360	2.0-6.0	0.5-5.0
Acetate butyrate	1.21	0.50	0.022	All	4-8	140-220	260-360	1.0-2.0	0.8-6.3
Ethyl cellulose	1.14	0.72	0.030	All	4-7	120-180	350-450	0.8-1.8	2.0-8.0
Polymethyl methacryl.	1.18	0.70	0.030	All	4-6	160-190	450-500	0.3-0.4	0.4-0.5
Polystyrene, Gen. Purp.	1.06	0.35	0.013	All	2-3	150-200	500-700	0.04	0.3-0.5
Shock-resist.	1.04	0.45	0.017	All	2-3	140-175	300-600	0.1-0.5	0.5-11.0
Styrene-acrylonitrile	1.09	0.45	0.017	All	1-3	190-200	400-425	0.2-0.5	0.3-0.5
Polyethylene	0.92	0.47	0.016	All	7-9	200-212	450-470	0.01	5.0-15.0
Polyvinyl, flex., filled	1.37	V.A.F.	V.A.F.	All	3-4	150-175	700-800	0.5-0.8	V.A.P.
Polyamide	1.15	1.60	0.066	All	5-7	290-310	385-470	0.4-1.5	1.0-15.0

Material	Tensile Strength, Psi.	Compres. Strength, Psi.	Flexural Strength, Psi.	Rockwell Hardness	Sunlight Exposure	Effect of: Weak Acids	Strong Acids	Weak Alkalies	Strong Alkalies
Phenolics: Woodflour	7,500	30,000	10,000	M115	Darkens	Slight	Attacked	Slight	Attacked
Cotton flock	6,700	26,000	10,000	M110	Darkens	Slight	Attacked	Slight	Attacked
Mineral	5,000	25,000	8,500	M105	Darkens	V.A.A.	Attacked	V.A.A.	Attacked
Fabric	7,500	25,000	11,000	M112	Darkens	V.A.A.	Attacked	V.A.A.	Attacked
Cord	7,500	20,000	12,000	M110	Darkens	V.A.A.	Attacked	V.A.A.	Attacked
Rubber woodflour	6,000	18,000	8,500	M68	Darkens	V.A.A.	Attacked	V.A.A.	Attacked
Silicone-glass fiber	4,500	12,000	11,500	M45	None	Slight	Slight	Slight	V.A.A.
Polyester-glass fiber	7,000	22,500	17,500	M113	Chalks	Slight	Attacked	Attacked	Attacked
Urea-formaldehyde	7,500	30,000	14,000	M118	None	Slight	Attacked	Slight	Decomposes
Melamine-formaldehyde	7,000	34,000	13,000	M117	None	None	Attacked	None	Decomposes
Cellulose nitrate	7,500	28,000	10,000	R105	Discolors	Slight	Decomposes	Slight	Decomposes
Acetate	4,500	25,000	9,000	R80	Slight	Slight	Decomposes	Slight	Decomposes
Acetate butyrate	4,800	15,000	5,500	R70	Slight	Slight	Decomposes	Slight	Decomposes
Ethyl cellulose	5,000	22,000	8,000	R82	Slight	Slight	Decomposes	None	Slight
Polymethyl methacryl	8,000	15,000	15,000	M95	Nil	Nil	Attacked	Nil	Nil
Polystyrene, Gen. Purp.	7,000	9,000	12,000	M78	Yellows	None	Attacked	None	None
Shock-resist.	5,000	7,000	6,000	M78	Slight	None	Attacked	None	None
Styrene-acrylonitrile	11,000	15,000	15,000	M82	Weakens	None	Attacked	None	None
Polyethylene	3,500	F.N.A.	F.N.A.	R11	Degrades	Resists	Attacked	Resists	Resists
Polyvinyl, flex., filled	2,200	F.N.A.	F.N.A.	50-90D#	Darkens	Slight	V.A.A.	None	Nil
Polyamide	9,000	10,000	11,000	R114	Slight	Slight	V.A.A.	None	None

Key to abbreviations: F.N.A.—Figures not applicable. V.A.F.—Varies according to filler. V.A.A.—Varies according to acid or alkali. V.A.P.—Varies according to plasticizer.

* Kcal./gram/sq.cm./°C./cm.
** In 24 hours.
# Shore durometer hardness.

materials engineer also should know the electrical and insulative characteristics of the many molded plastics. Although price is not exactly within his province, the cost per pound of the material should be known from a comparative standpoint. With so many materials from which to choose, functional selection very often presents a difficult problem.

Physical Properties

It is impossible for even the plastics expert to commit to memory all the respective physical property values of all the molded plastics. For that reason, both the plastics engineer and the materials specialist have to refer to property charts. Many such charts are available —some of which give quite abbreviated figures and others which contain exhaustive information of a highly technical nature. Table I has been prepared with a slightly different concept. The information appearing on the chart is slanted to that large group of engineers who possess a general knowledge of all engineering materials, but who wish to refer to some of the important

Table 2. Specific Gravity Table. *

Aluminum	2.67	Methyl methacrylate	1.18
Asbestos	2.40	Mica	2.90
Brass (average)	8.40	Nickel	8.80
Bronze	8.80	Nylon	1.15
Butyrate	1.21	Phenol-formaldehyde	1.35
Casein	1.35	Polyester-glass fiber	1.90
Cellulose acetate	1.32	Polyethylene	0.92
Cellulose nitrate	1.47	Polystyrene	1.06
Copper	8.87	Polyvinyls	1.37
Ethyl cellulose	1.14	Porcelain	2.40
Glass	3.15	Rubber (hard)	1.47
Iron (cast)	7.22	Steel	7.85
Magnesium	1.74	Tin	7.35
Melamine-formaldehyde	1.48	Urea-formaldehyde	1.48
Lead	11.38	Zinc	7.06

* With the exception of Ebony, Lignum Vitae, and some grades of Mahogany, all woods have a specific gravity of less than 1.00.

properties of the most commonly used plastics. In using a chart such as this, it must be kept in mind that the figures shown are not exact, but are average in some cases and approximate in others. They are vastly important, however, from the standpoint of determining comparative values.

Before attempting to utilize the data given in Table 1, the engineer must make sure that he really knows the meaning of all the properties listed. Of course, headings that refer to properties such as exposure to sunlight, and the availability of colors require no explanation. However, such terms as tensile strength, specific gravity, flexural strength, moisture resistance, dielectric strength, and many other similar characteristics should be understood. A basic knowledge of the full meaning of these terms is essential. Therefore, the following definitions of properties and brief insights into the test methods used should be helpful to the engneer who is charged with the responsibility of selecting the best plastic material on the basis of function.

Specific Gravity

Of particular importance in the preliminary selection of a plastic material is its relative weight per unit of volume. This is expressed by its specific gravity. Under standard conditions, a cubic inch of water weighs 0.0361 pounds. This figure should be remembered as a constant when calculating the actual weights of known volumes of all materials.

Specific gravities are merely ratios, but important ones, which disclose at a glance the relative weights of all materials. The plastic materials have comparatively low specific gravities, all within the range of 1-2. Specific gravity tables appear in most engineering handbooks, but they seldom include the numerous plastics. Table 2 gives the approximate range average specific gravities of the most important ferrous and non-ferrous metals, as well as the most commonly used molded plastics.

A glance at this table indicates that polyethylene, with a specific gravity of 0.92, ranks among the lowest. Polystyrene, ethyl cellulose, and nylon are also light weight materials in the thermoplastic group. Among the thermosetting materials, the phenolics average 1.35, and the ureas and melamines are higher at 1.48. Both the cost estimator and the product designer must pay special attention to this particular property for figuring the cost of plastic molded parts. From a physical standpoint, low specific gravity means lightness in weight, often a deciding factor in many applications. The engine shown in Figure 1 illustrates the use of plastics for a military application where specific gravity is an all-important factor.

Thermal Insulation

The term "insulation" refers to two properties; insulation against electricity, and insulation against heat. The engineer, though, must know which materials will resist the passage of these two sources of energy. The molded thermosets possess both insulative properties. That is why he would specify phenolic plastics for cooking utensil handles, casings on electric iron plugs, and housings for ignition parts in the automotive field.

Plastics are not the best insulators known, but they do rate high for both thermal and electrical insulation. Inasmuch as there has to be some means of comparing these properties from one material to another, definite values have been established. In the case of specific gravity, only one value is necessary; with insulation, however, a greater number of factors have to be considered. For example, rsistance to heat may refer to either thermal conductivity or flame resistance of the material. Similarly, electrical resistance can pertain to more than one property; insulation against current passing either through the material or across its surface by arcing.

The thermal properties of molded thermosets differ considerably from those of the thermoplastics. The heat-hardening plastics withstand higher temperatures. It should be kept in mind, however, that there is a wide difference between molding temperatures and the temperatures used in operating the molded parts. Only the latter properties are considered in this discussion. From an engineering standpoint, heat and insulation characteristics entail four phases; (1) flammability or breakdown, (2) heat conductivity, (3) heat distortion, and (4) thermal expansion.

So far as flammability is concerned, none of the

thermosetting materials support combustion. At the other extreme is found cellulose nitrate, a thermoplastic well known for its high degree of flammability. The remaining cellulosics are only slightly flammable, as are the acrylics and vinyls. In general, then, it should be remembered that the thermoplastics, with the exception of nitrate, are partially resistant to flame.

The thermosetting compounds are entirely resistant to ignition, but are subject to breakdown or decomposition under extreme heat. For example, phenolic heater plugs used for electric irons will become brittle and tend to char when subjected to continuous temperatures exceeding 500° F. The brightly colored ureas will discolor and change from translucent to opaque when exposed to elevated temperatures for any length of time. Most thermoplastics will lose their rigidity when heats of 200° F. or more are applied. The polyamides present the most notable exception, as may be seen from Table 1.

Heat conductivity may be defined as the rate at which heat flows through a material. Therefore, the better its insulating properties, the slower will be the rate of heat flow through a material. A low thermal conductivity value is desirable in applications where high insulating properties are wanted.

Resistance to high operating temperatures should not be confused with low conductivity, however, for there is a wide difference in the two properties. A mineral-filled phenolic molded part will withstand much higher operating temperatures than a phenolic with woodflour filler, yet the latter type of molding possesses a much lower thermal conductivity value. Consequently, the specifications for insulation on an electric flat iron should call for a mineral-filled phenolic plug, but the handle should be made of woodflour-filled phenolic.

The heat distortion point may be defined as the temperature at which a material will start to change its shape under concurrent application of heat and mechanical stress. The thermosetting materials again surpass the thermoplastics in this respect, for they have a range in the vicinity of 240-300° F. Most of the thermoplastics have heat distortion points 100° lower, although high-heat polystyrene and the polyamides are somewhat superior in this property. Only in cases where simultaneous heat and mechanical loads are to be applied is it necessary to give consideration to heat distortion values.

All the numerous plastics exhibit different shrinkage factors when molded. The amount of this shrinkage, although relative from one material to another, is often governed by the molding process used. In general, plastics have coefficients of expansion which are anywhere from 2-10 times greater than those of metals. This property is important, therefore, for the design engineer when considering applications which combine metal and plastics. In such applications, extreme care must be exercised in arriving at the most functional design.

Most of the steering wheels on today's automobiles are constructed of plastic and steel. When first introduced, many of these wheels were found to crack in service after a certain length of time. In most cases, this fracturing was caused by latent shrinkage of the molded part which set up internal stresses within the wheel. If an insulating material has a shrinkage which is ten times greater than the metal it surrounds, it can readily be seen how internal stresses are set up that would ultimately cause a break.

(Photo courtesy: Bakelite Co.)

Fig. 1. Plastic cowling on engine of flying model plane illustrates an application where light weight (low specific gravity) is important.

The design engineer responsible for specifying dimensional values on products which combine plastics and metal must know the most practical thickness to recommend. The material engineer, on the other hand, should know the correct materials. This is an important detail from the functional, rather than artistic, standpoint. Although there are many recognizable disadvantages in the high shrinkage values of molded plastic parts, shrinkage is used to advantage in many applications.

In the assembly of plastic handles on metal shanks, the molded part can be taken directly from the mold while hot and forced onto the metal. As it cools, shrinkage is utilized to abet the grip and make a tight assembly. This property was taken into consideration in designing the phenolic plug shown in Figure 2. Another way in which shrinkage is used advantageously is found in both the compression and injection molding processes. In these operations, it is usually desirable to have the molded parts cling to one or the other half of the die as it opens. With the aid of slight undercuts, this is accomplished more readily because of the tendency of the material to cling as it cools.

(Photo courtesy: Bakelite Co.)

Fig. 2. Shrinkage of molded phenolic metal shanks provides tight assembly in electrical plug.

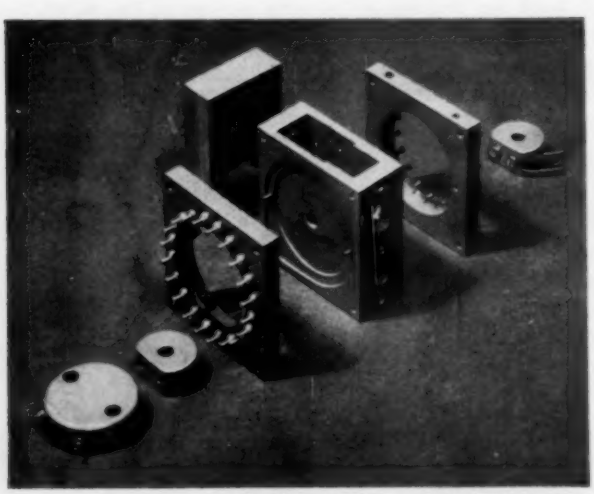
Other advantages of shrinkage may be utilized in the design of a plastic molded product. Exterior undercuts on molded parts can be incorporated in instances where the undercut depth does not exceed the expected shrinkage of the material. For example, a rib or helical thread 0.005-0.010 inch deep could be placed on the external side of a molded part if the material being used possesses similar dimensional shrinkages. Thus, the molded item can be removed or released readily from the cavity as it cools.

It is common practice to compare thermal expansions of metals by referring to their respective coefficients per degree Centigrade. Plastics engineers think more in terms of contraction and, hence, compare shrinkages of the various materials. An asbestos-filled phenolic has a shrinkage value of about 0.004 inch per linear inch; a woodflour-filled phenolic usually shrinks about 0.008 inch per linear inch; and the vinyls have shrinkages varying from 0.018-0.025-inch per linear inch. In applications where shrinkage happens to be an important part of the specifications, correct values should be definitely ascertained.

Electrical Insulation

In the early days of plastics, molded electrical parts were made chiefly from the bituminous cold-molded compounds, although some applications using black and brown phenolics commenced to appear. Today, electrical engineers are as vitally interested in insulating materials as they are in the conductive metals. Prior to the advent of the synthetics, the electrical industry had to depend on porcelain, slate, or glass for most of its insulation. However, all these inorganic substances, besides being very heavy, are quite fragile because of their brittleness.

The introduction of numerous types of plastics was received with enthusiasm. These new materials possessed good insulating properties, as well as excellent structural characteristics. Today, nearly all wiring devices such as attachment plug caps, wall plates, cube taps, receptacles, etc., are made from the ureas and phenolics. Conduit fittings manufacturers now use these materials instead of porcelain and cold-mold compounds. The thermoplastics also are used to a large extent for insulating bushings in junction boxes. The electrical commutator parts shown in Figure 3 utilize the new glass-reinforced plastics.



(Photo courtesy: Owens-Corning Fiberglass Corp.)

Fig. 3. Electrical commutator molded parts of plastic reinforced with chopped glass strands.

As with thermal insulation, it is the measurement of energy permitted to pass through an object that is of particular interest to the materials engineer. Current or voltage will tend to either go through or skip across the surface of an insulating material, so there are two types of electrical insulation resistance; surface, and volume.

Volume resistance is expressed as a function of dielectric strength, and is a measure of the maximum voltage that an insulating material can withstand before puncture. The amount of voltage applied must be divided by the thickness of the material in order to make a standard comparison. The length of time that current is applied also must be taken into consideration. Dielectric strengths, therefore, are expressed in volts per mil, and time and temperature are important qualifying factors.

In the thermosetting group of plastics, the melamines in particular are superior, whereas silicone-glass fiber exhibits the lowest resistance to current flow. Polyvinyl chloride rates as one of the best electrical insulators in the field of thermoplastics. Nylon possesses fair dielectric strength and is used for coil forms, but the polyvinyls head the list in this property and serve as excellent coverings for electrical wire.

Many of the thermoplastics are used in film form as insulating foils. Although general-purpose polystyrene has a very high dielectric strength value, brittleness limits its use as foil to a certain extent. To offset this disadvantage, however, polystyrene possesses an extremely low water absorption value. This moisture resistance is a highly important property for electrical insulators. As housings for all types of electrical apparatus, the use of plastics is diverse. In the electro-mechanical field, plastics are used for distributor caps, rotors, and innumerable other automotive applications.

A condition not found in the study of thermal properties is that of arcing. An arc is caused by electrical currents jumping from one terminal to another, accompanied by flashes of varying heat intensity. This arcing tends to carbonize organic insulators across the path it follows, thereby nullifying a certain amount of the original insulating properties. The carbon formed by arcing across a path will cause each subsequent flash to become greater, because carbon itself is a conductor.

The phenolics are quite susceptible to arcing, and are not considered good insulators where electrical flashes are likely to occur. Asbestos fillers are used to rectify this condition to a certain degree. Urea and melamine molding compounds will not carbonize, and, therefore, may be specified in applications where arcing is to be expected. Regardless of which type of insulator is selected, it is imperative that the surface between the terminals be kept clean, dry, and entirely free from oil or dirt. Where intense heat is expected such as in high-tension arcing, inorganic insulators made from ceramics or glass should be specified.

(Continued in March Issue)

H. R. STEPHENS, *Research Chemist*
Research Division,
Polychemicals Department,
E. I. du Pont de Nemours & Co., Inc.
Wilmington, Del.

High-Pressure Teflon Seals and Closures

Self-sealing principle is used to design seals and closures that provide excellent high-pressure seals.

TEFLON tetrafluoroethylene resin has been used to make packing rings for sealing poppet valves in high-pressure pumps, and for self-sealing closures in high-pressure chemical reaction vessels. Circular in cross-section, the rings have been used in the rupture disc assemblies of autoclaves, and are still sealing perfectly after 110 consecutive runs.

A plastic inert to almost all chemicals and, in certain instances, stable at temperatures as high as 300° C., Teflon gives superior performance in high-pressure seals for injection pump valves and chemical reaction vessels.

The simplicity of design made possible by the use of Teflon packing-ring closures is particularly desirable because of the inherent complexities of Bridgman closures and all traditional metal-to-metal contact seals. The use of these rings has provided outstanding seals that are subjected to varying temperatures and pressures. These rings can be used many times and still provide satisfactory self-sealing closures.

Packing Rings

The use of Teflon resin in packing rings for poppet valves (see Figures 1 and 2) makes it possible to pump

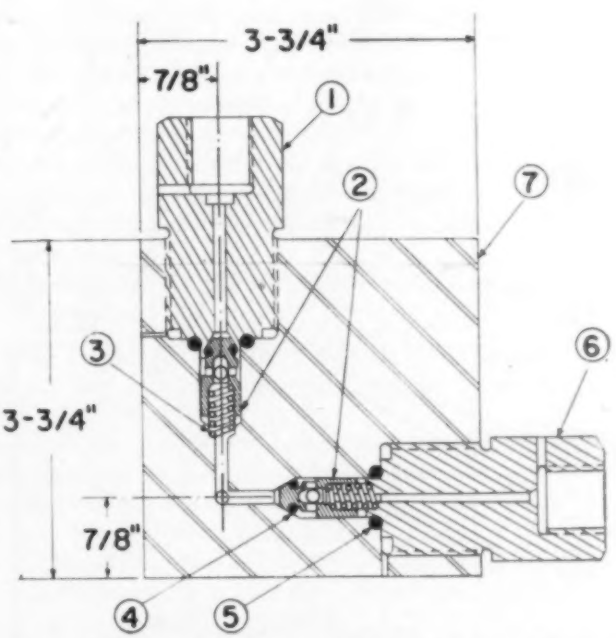


Fig. 1. Schematic drawing showing front elevation of Teflon packing-ring poppet valve assembly: 1—Suction valve follower; 2—Valve poppet; 3—Spring; 4 and 5—Teflon rings; 6—Discharge valve follower; and 7—Valve body.

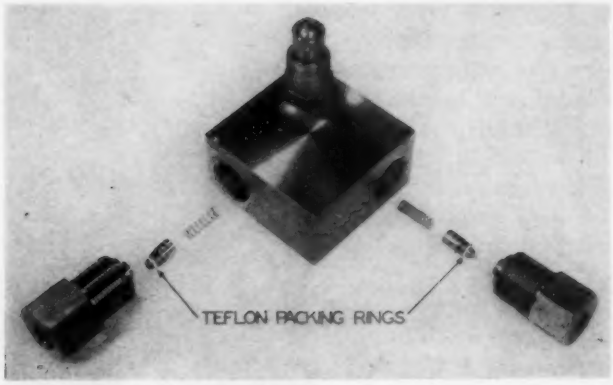


Fig. 2. Exploded view of Teflon packing-ring poppet valve assembly.

organic liquids and catalyst solutions which would swell and disintegrate the synthetic elastomers customarily used on poppet valves. Since Teflon is a thermoplastic resin, not an elastomer, it requires special treatment when used for sealing poppet valves.

A packing ring of Teflon is deformed by stress when forced into the retaining groove of the poppet, but this strain is removed by heating the completed poppet assembly at 350° C. for 30 minutes. Poppet valves prepared in this manner perform satisfactorily in 15,000-psi. pumps. Details of the ring assembly are shown in Figure 1.

A Teflon packing ring has been used in a very simple self-sealing closure designed to hold 22,500 psi. of

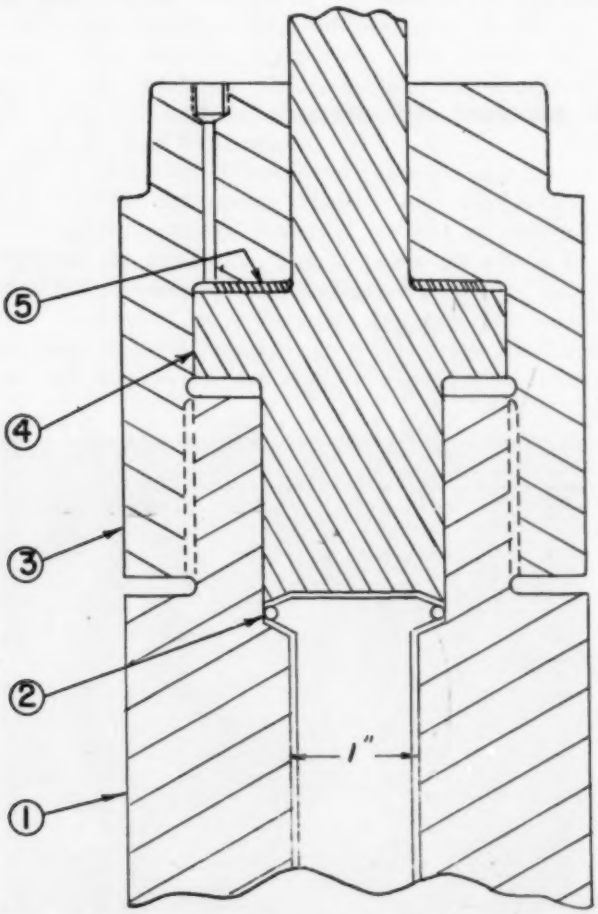


Fig. 3. Schematic drawing of Teflon self-sealing closures in chemical reaction vessel: 1—Tube body; 2—Teflon ring; 3—Head nut; 4—Head; and 5—Thrust ring.

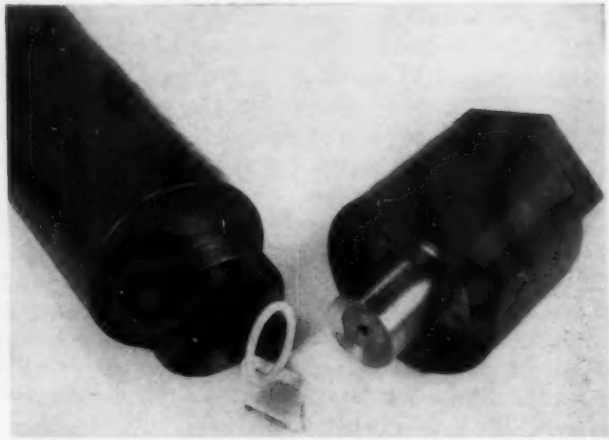


Fig. 4. Teflon seals tube liner and head button of chemical reaction vessel.

pressure in a one-inch diameter chemical reaction vessel (see Figures 3 and 4). The packing ring was placed in the 45° angular space between the flanged tube-liner and the beveled head-button. Initial sealing was accomplished by compressing the packing ring with hand-pressure torque on the head nut. The self-sealing principle then was applied to increase the tightness of the seal in proportion to the increase in pressure within the vessel.

Rupture Disclosures

A rupture-disc closure assembly, consisting of shear

(*Continued on page 124*)

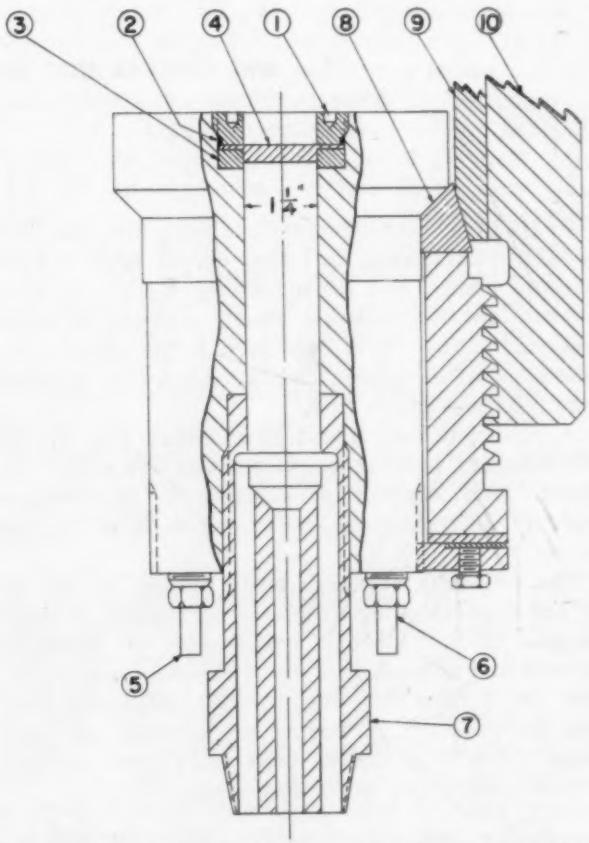


Fig. 5. Schematic drawing of Teflon rupture-disc closure assembly: 1—Retaining ring; 2—Teflon ring; 3—Shear block; 4—Rupture disc; 5—Gas inlet; 6—Liquid draw-off; 7—Rupture disc vent; 8—Metal seal ring; 9—Autoclave liner; and 10—Autoclave body.

PAUL E. FINA
Director of Sales Engineering,
Fiberite Corp., Chicago, Ill.

How to Avoid Plastics Misapplications

TO INSURE a successful application for plastics materials must be evaluated and selected carefully. The failures attributed to plastics in the past are mostly due to misapplications. If the plastics engineer has a sound and basic knowledge of available materials and has thoroughly reviewed the requirements of the intended plastics application, he can make an educated selection of the correct material.

We have seen gears produced from nylon that have failed miserably, but also we have seen nylon gears that have been the perfect answer. We have seen housings produced in polyester type materials that have warped, crazed, and cracked; yet many successful polyester applications exist. We have seen phenolics that break easily or break down in certain chemical solutions, but then the converse is also true. Thousands of thermoplastic applications are sound, but a few hundred thermoplastics applications incorrectly engineered leave a bad taste. We know that most styrenes are sensitive to heat, have poor chemical resistance, and are brittle. But some molders continue to misapply styrene in lieu of some of the superior thermoplastics. Perhaps the time has come to educate the end-users and their engineers.

Occasionally, various publications have printed editorials or articles stressing the use of a sound engineering approach to plastics applications. It indicates that the problem is worthy of rhetoric. Let us gather together some of this argumentative discussion and determine what is needed.

Many of us remember the handbook that Boonton Molding Company distributed in the past. It was a true treatise. An embellishment of such a book would be edifying both to and for the plastics industry. Once published, it could be reviewed annually to encompass the additions, alterations, corrections, and improvements that have occurred within the year.

The handbook should include the following:

(1) A progressive and dynamic system for the proper selection or elimination of plastic materials for general or specific applications.
(2) A description of the properties of various plastic materials.
(3) A comparative evaluation of materials based on end-properties.
(4) Design data based on grouped physical properties of plastics.

For the instrumentation of such a handbook, some of the following objectives can be employed:

(a) The classification of all trade names.
(b) A chart grouping similar properties.
(c) Compilation of all proven applications.
(d) Recapitulation of all valid test results.
(e) Constant exploration for new end-users.
(f) Incorporation of the limitations of certain plastic materials.
(g) Pointing out the adverse effects of over or under engineering.

All the aforesaid are intended as "Food for Thought". They are not exhaustive nor can they be impugned readily.

In conclusion, it can be said that a doubtful application had best be left alone. A customer will appreciate honesty. In the long run there will be greater usage of plastics, mainly because of good will promoted. The resources for plastics are unlimited, and new materials will be forthcoming to meet the requirements of the doubtful applications.

—THE END

ROBERT E. WILLIAMS, *President,*
Southern Casting Co.
Sevierville, Tenn.

Repairing Aluminum Castings with Metallic Resin Putty

Epoxy putty is used in the foundry to repair defective castings, modify patterns, and cement gates.

A RECENTLY marketed plastic compound has proved itself a most versatile and valuable tool in the production of aluminum castings by our company for both industrial and consumer products. The material, an epoxy resin compound containing powdered aluminum, is currently being used by us for salvaging defective castings, cementing gates to patterns, and for making modifications in the patterns themselves. Upon occasion, it has even been used to caulk metal air lines carrying 130 psi. of pressure. In every instance, this material, Metalset A2, manufactured by Smooth-On Mfg. Co., Jersey City, N.J., has shown itself superior to prior methods in that it is easier to use, cheaper, more efficient, and more acceptable to our customers.

The metallic putty originally was tested by our company primarily as a patching material. After more than one year of use, the compound has shown itself to be the best available material to repair imperfect castings when these castings are not destined for structural or mechanical uses (see Figure 1). Use of Metalset has virtually eliminated aluminum soldering from our foundry.

Southern Casting engages in production and job casting, and specializes in aluminum industrial castings. Customers range from chair manufacturers, merry-go-round creators, to governmental private agencies involved in atomic energy activities. Casting defects, such as miss-runs, raised cores, and sand cracks account for a disturbing number of rejects in a normal run. Naturally, the percentage in a specific run varies with the complexity, size, and coring of the casting. Table 1 gives an idea of the variations in number of rejects among common items cast in the plant.

Defects in castings serving decorative or protective functions formerly were patched by aluminum soldering. The average cost for the required material was about 7¢ per hole. More important than this cost was the fact that aluminum soldering is a laborious and sometimes unreliable method. Tools and material required for this operation include solder and flux, torch and fuel, wire brushes, burnishing tools, and considerable time and patience. Most repairs made in this way by a semi-skilled, careful aluminum solderer would withstand acid baths. Unfortunately, however, only one

Table 1. Rejects and Repairs in Cast Products.

Item	How Cast	No. in Run	No. of Rejects	Patched by Metalset	Remelted
Chair arms	Two on a plate in a 28-inch square flask.	130	39	34	5
Chair backs	One on a plate in a 20-inch square flask.	465	36	26	10
Junction boxes for outdoor theatre speakers	Two on a plate in a 13 x 18-inch flask.	950	64	40	24

Fig. 1. Three cast aluminum outdoor theatre ramp boxes in various stages of repair: (left) with original defect hole; (center) hole after patch has hardened; and (right) repaired casting after patch has been machined and finished.

Fig. 3. Foreleg hole under repair. Sand is being placed in hole, which has been stuffed with paper, as the base for metallic epoxy compound patch.

Fig. 2. Cast aluminum merry-go-round horse is discovered to have a large hole on its foreleg, caused by a raised core, as casting sand is being removed.

Fig. 4. Excess of metallic epoxy compound has been applied in patching operation to allow for final smoothing operation.

Fig. 5. Left-over epoxy compound is applied to other minor imperfections and surface blemishes on the cast horse.

individual in our company has sufficient experience with this procedure to produce passable repairs.

Foundry Applications

Table 1 also shows the number of rejects that can be patched with the metallic putty, and the number that cannot be patched in this manner and must be re-melted. These figures would hold about the same for aluminum soldering. The advantage of the patching compound is not in the numbers of rejects saved from the melt pot, but the fact that any of the five men in our shipping and clean-up department can make a passable repair using Metalset. In addition, this repair can be made for about half the material cost and about one-third the time with much less skilled labor. Further, the use of the metal putty encourages the salvaging of castings that most likely would not have been aluminum soldered because of the nuisance involved being greater than the possible savings.

Fig. 6. Completely patched horse before final machining.

The epoxy compound is extremely easy to mix and use. It comes as a two-component system, the basic resin containing finely-powdered aluminum and a liquid curing agent. Curing is by polymerization or chemical action, and shrinkage is 0.002 inch per inch. Other physical properties include a compressive strength of 14,400 psi., and a Rockwell hardness of M-70.

Each unit of Metalset has two components; a bottle that contains the proper amount of curing agent, and a can of the epoxy compound. When mixed together, the material has a fairly short pot life and should be used within a half hour. It has the property of staying where it is put; horizontally, vertically, or upside down. The metallic putty can be applied to a clean surface with almost any sort of tool, such as a knife, spatula, or ground-down hacksaw blade. Application is as easy as frosting a cake.

Since it hardens through an exothermic chemical reaction, and the heat given off speeds the curing, it is advisable to apply the material heavily. Figures 2-6 show application of Metalset to patch an aluminum merry-go-round horse. The patch cures in a few hours at room temperature, and any excess can then be removed, by a simple filing or grinding operation.

Fig. 7. Left side of this pattern has been built up with metallic epoxy compound to increase the wall thickness of final casting. Material has been applied to cleaned surface, and smoothed to conform with surrounding metal.

Once mixed, the patching plastic has to be used or wasted. As shown in Figure 5, this availability of material has promoted the cosmetic repair of additional, negligible casting defects that would be acceptable normally to our cusomers. Little or no attempt would previously have been made to use aluminum solder to remedy such insignificant defects. The result is that Southern Casting is turning out cast aluminum products having greatly improved quality and appearance without any actual additional expenditure.

Patching of defective castings is not the only use to which this compound can be put. Figure 7 shows how the wall of a pattern has been built up so that the final casting will have increased wall thickness. Furthermore, as shown in Figure 8, gates can be cemented to patterns, using Metalset as an adhesive.

Fig. 8. Gates for chair leg pattern have been cemented in place with Metalset metallic epoxy resin compound.

Conclusions

Naturally, this plastic material cannot be used in place of helium arc welding to repair castings destined for mechanical or structural applications. Our castings for use at Oak Ridge must be perfect without any repair or salvage effort. During the period of more than a year that we have been using the metallic putty, however, we have found it to be an extremely valuable tool for its proper application. It saves time and money and, in addition, helps us to produce a better product with considerably less effort.

—The End

Cutting and Trimming of Plastics With the Panel Saw
(Continued from page 107)

and certain other thermoplastics. Phenolics, melamines, and glass-reinforced polyesters do not behave well.

In "up" cutting, the blade rotates in the same direction as in "down" cutting, but travels in the opposite direction. The teeth move downward into the stock, and impart an upward or lifting thrust commensurate with the depth to which the blade is lowered into the stock. This lifting effect is at a minimum when the blade is slightly (about 1/16-inch) below tangent at the bottom surface of the stock (just barely extending past the bottom of the stock). With stock thicker than about ½-inch, the lifting effect increases considerably and the stock must be held down.

Stock hold-downs are required in "up" cutting. The stock tends to lift at both the start and finish of the cutting pass, so the cutting table must be provided with manual cam clamps on both sides of the stock at the fence end and at the start of the "up" cut. A hold-down bar running the full length of the stock on both sides is advisable when "up" cutting acrylic plastic sheets ⅛-inch thick; ¼-inch sheets will cut safely in both directions when simply weighted down.

Although somewhat inconvenient, an auxiliary cutting board with a kerf can be placed on top of the stock being "up" cut to support the fibers as they are parted, and to neutralize the lifting effect of the blade teeth. Every hold-down device, of course, must be justified by the production time gained, and each cutting application will require specific fixtures. When the cutting blade is sharp, however, the "up" cut will be as perfect as the "climb" cut with respect to non-chipping of either masked or unmasked stock.

Panel Saw Equipment

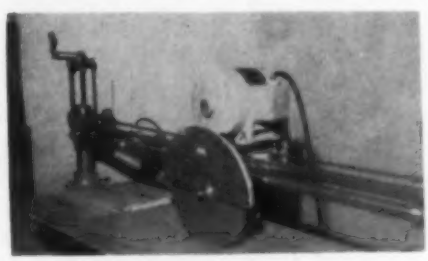
Panel saws are relatively inexpensive. Our company's saws are made in capacities ranging from 4½-12½ feet in length of carriage rails. These saws are driven by a chain and sprocket system, with the control located at one end of the carriage rail. Models are made available for manual (MLR) and combined manual-automatic (MA) operation. The manual models have the saw carriage advanced and retracted by means of a handwheel (see Figure 4). The automatic models (see Figure 5) are equipped with variable-speed drives for carriage movements from 8-50 feet per minute, and have adjustable limit switches which automatically stop the carriage at the end of the predetermined pass and return it to the starting position.

Manual operation with either type of saw model is useful in cutting very thick stock, and for determining optimum cutting speed prior to setting up for automatic cutting. With the combined manual-automatic models, manual operation is achieved by throwing the clutch mechanism on the carriage drive. Both the manual and automatic models can be tilted to produce 45° bevel cuts, and are available with blade diameters ranging from 6-14 inches.

When considering the purchase of a panel saw, it is important to note the depth of cut afforded by the equipment. This is of special importance when developed shapes, such as corrugated glass-polyester awnings, formed kitchen counter-tops, and certain extruded channels, are to be cut. The scalloped edges of reinforced-plastic awnings are produced by cutting across the corrugations at a 45° bevel setting.

A panel saw with a 6-inch cutting depth has been proved to be the most practical means of accurately performing 45° miter cuts on combination plastic-plywood kitchen counter-tops. The full capacity of a 14-inch diameter blade is utilized in cutting the backsplash, top, and front apron of the counter-top in one pass.

—The End



E. CHRIS MIREAU, *Plastics Division Manager, Pastushin Aviation Corp., Los Angeles, Calif.*

GFR Process for Fiberglass–Resin Low–Pressure Laminates

Details of a new, centrifuge-type method of manufacturing symmetrical parts which gives excellent product uniformity.

DURING the past five and one-half years, Pastushin has been expending considerable effort towards the development of a process which would facilitate the manufacture of plastic fuel tanks. This research was authorized by our president, who felt that plastics held great promise in this field and some day would supersede the use of expendable metal fuel tanks. The company's main business at that time was the manufacture of jettisonable fuel tanks and he felt it should be prepared to switch to plastics whenever the latter's development would allow phasing it into the tank business.

The most logical process proved to be based on low-pressure laminates of fiber glass-reinforced polyester resin. Research eventually threw out any bag technique for molding the cloth laminates due to the low production rate inherent in that process, and the use of matched male and female dies because of the non-uniformity of material distribution and high cost of equipment involved. Consequently, a new method of manufacture had to be developed, and Pastushin evolved a centrifuge system in our GFR process (see Figure 1).

This system permits the manufacture of mat-resin moldings to a closely controlled tolerance not only as to thickness, but also in uniformity of glass:resin ratio throughout the part. The human element is eliminated to the extent that the operator is practically restricted to the manipulation of switches on a control panel. The average person can be taught the operation in a few days.

By this automatic system, each part produced is identical. The only possible variables are differences in the resin, inhibitor, catalyst, accelerator, and/or glass used in the process, or in mechanical failure of the equipment. These variables in the materials are subject to quality control, eliminating the usage of sub-standard lots.

The GFR Process

Basically, the GFR process can be described as the automatic distribution of fibrous glass and resin to a mold surface by metering an exact, predetermined ratio

of chopped glass strands to resin through a hollow tube (probe) and ejecting it against the inside of a mold surface which is being spun on its longitudinal axis in a centrifuged bell-jar or shroud. The rate of travel of the probe in the cavity of the mold can be varied from 0-30 inches per minute, and is controlled by a cam-actuated drive.

At the mouth of a conical section, the descent of the probe is slow for a given over-all thickness and accelerates at a controlled rate, depending on the contour, as it approaches the nose. For varying thicknesses, the probe's speed of descent is guided by the cam so that circular or thicker areas can be molded integrally. To obtain a ⅛-inch thick laminate on a part 18 inches in diameter in one complete cycle, for example, the probe would move at the rate of 10 inches per minute.

The centrifuge action insures equal distribution of material in the circular section and, by control of its speed, prevents the resin from migrating up or down the mold. This places and holds all material at the point where it is deposited, and compacts it at the same time.

After material is deposited in the mold, the shroud is moved to the next position. Here, a bag is inserted and the trapped air evacuated automatically from the lay-up. After the part cure cycle has been completed, the part is removed from the mold by using an automatic hoisting device and quick-acting flash-heat (see Figure 2).

The probe is a hollow tube through which chopped fibers are blown at a velocity depending on the production time cycle rate, and strike a cone which deflects the fibers out against the mold surface in a random pattern. The greater the diameter of the part, the more random the pattern because they tend to leave the deflecting surface in a horizontal plane and start tumbling when they hit the air space between the deflector and the mold surface.

In order to gain a more unidirectional pattern, we can vary the air pressure in the probe from 0-15 cubic feet, the shape and size of the deflector cup, and the speed of the centrifuge. The centrifuge has been operated at speeds from 280-1,000 rpm. This is the range used to date, but is not a limiting factor. By different combinations of these three factors, the directional pattern of the chopped strands can be controlled to impart directional strength properties to the finished laminates to a limited extent. The present probe size limits the automatic action to a minimum inside diameter of nine inches, but smaller probes can be made if the necessity arises. Meantime, we use the conventional preform method or a woven sock to make an insert for any conical sections below this diameter.

All parts are bagged in the GFR process by the quick acting bell-jar principle, using a reusable bag developed at Pastushin (see Figure 3). A tube is supported along one side of the inside diameter of the probe which pumps resin out of a nozzle with two orifices at the end of the probe just ahead and behind the fibers.

To date, the largest section molded has been 44 inches in diameter and ten feet in length. The only practical limitation to the size which can be molded is the size of the building to house the unit. The equipment must be at least twice as high as the molding plus a few feet of leeway, and the diameter is limited in size only by the degree of strength which can be built into the shroud for the centrifuge action.

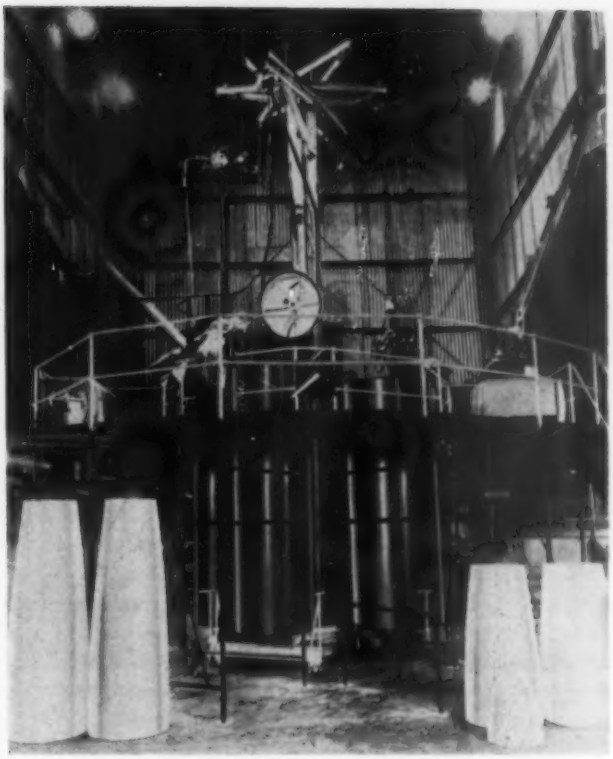


Fig. 1. Over-all view of GFR Carousel at Pastushin.

Materials Used

At present, an evaluation program is being carried out with various types of resins, binders, catalysts, and other variables to accumulate test data on their suitability for use with the GFR process, and to determine the physical properties obtainable when so used. Test results obtained with General Electric AR-403 general purpose polyester resin and Owens Corning No. 851 glass roving with a modified silane finish gave the average physical properties shown in Table 1. Test specimens were prepared and conditioned and tested in

Fig. 2. View into GFR Carousel showing (left to right) part being cured in mold under vacuum; part being removed from mold; and empty shroud.

Table 1. Typical Laminate Properties*

	Test Method**	Conditioning** Std.	Wet
Tensile strength, psi.	1011	53,700	47,700
Compressive strength, psi.	1021.1	33,600	18,600
Flexural strength, psi.	1031	60,200	37,200
Modulus of elasticity, psi. x 10^6	———	2.65	2.25

*All specimens tested in warp direction only.
**Of Federal Specification L-P-406b.

accordance with the applicable test methods of Federal Specification L-P-406b.

Fiberglas-polyester resins are especially adaptable to parts which require resistance to weathering, low thermal conductivity, good electrical properties, and high impact strengths. They have an appreciable advantage in strength:weight ratio over metals. In fuel tanks, for example, this type of plastic permits easier assembly in the field, a visual check as to level of fuel in the tank, resistance to denting fiberglas laminates have no yield point), lower tooling and equipment cost, elimination of critical materials such as aluminum, plus, in the case of droppable fuel tanks, the fact that the dropped tanks do not add to the enemy's scrap metal supply.

Process Evaluation

For military usage in times of war, only raw materials that are relatively non-critical and abundant are available, and new processing capacity must be rapidly and readily increased to meet demand. The GFR process provides a machine requiring a minimum of technical training on the part of the operator, and makes for a high production rate on relatively inexpensive, readily built equipment which can increase the flow of production in case of emergency.

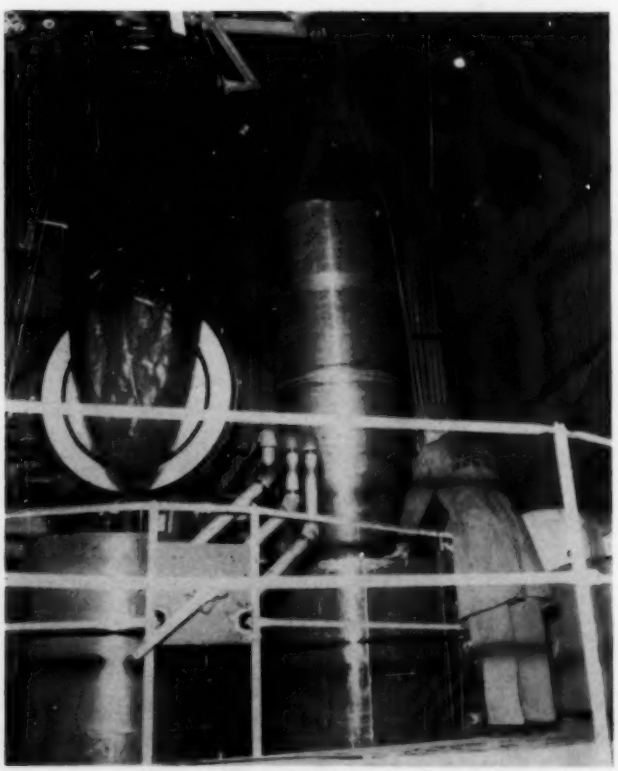


Fig. 3. Reusable vacuum bag being lowered into mold.

The GFR process equipment is the first big step towards automation in this part of the plastics business. We believe the process to be a genuine advantage to the manufacturers of fuel tanks, missile and jet engine containers, paravanes, flotation gear, missile body components, and chemical containers, as well as being suitable for many novel industrial uses (see Figure 4).

Until recently, Pastushin's Plastics Division was engaged wholly in research and development, and an extensive program was directed towards the reduction of the GFR process to a productive operation. The present design was finalized as the most practical, and was constructed in June 1956, utilizing the GFR process which had been perfected previously. A continuing program of development has been laid out to make other refinements and adaptations to the machine to increase its versatility.

Although the GFR Carousel, illustrated in Figure 1, as it now stands, gives products that will compete price-wise on a competitive basis with press moldings, it is actually intended to be used only for developing new jobs and handling small-quantity prototype orders. Large orders are run on production equipment designed for high production rates, but using the same patented features and process incorporated in the GFR Carousel (see Figure 5).

Three different types of production lines may be used, each one applicable to certain types of parts. One line uses autoclaves, another uses individual heat-exchangers, and the third uses a "first-in-first-out" oven for curing. The lines designed for conveyorized operation, and work stations are provided to replace the operation points now represented on the GFR Carousel.

The GFR process will handle parts which are symmetrical about a centerline to ± 10% of nominal thickness in a range varying from 0.125-0.50 inch. The GFR process cannot compete with press molded parts in this respect, but is superior in void freeness and uniformity of parts, and greater potential for productibility and latitude in varying part thickness while maintaining uniformity, if the designer so desires. The molds are made of 1/16-1/8-inch aluminum or steel by spinning, rolling, or bulge forming.

The GFR process, utilizing the centrifuge principal and automatic placement of glass and resin to the mold surface, is restricted to parts which are approximately symmetrical about a centerline, and which deviate only slightly in the bodies of revolution. We have experienced that parts out of round by as much as 20% between the major and minor axis may be molded holding these tolerances, but this is entirely contingent upon the individual eccentricity of the mold line and each case must be judged accordingly. Stiffener rings may be molded integrally if they are in a latitudinal section.

Longitudinal stiffeners require secondary bonding. Straight line elements in longitude can be molded and, theoretically, even a slight backdraft can be handled. This can be accomplished because the shroud can be flash-heated to 350° F. in three minutes, causing the thin metal mold to expand and break away from the part. Flat areas in the longitudinal and latitudinal directions also can be molded if of reasonable size. Parts are lifted

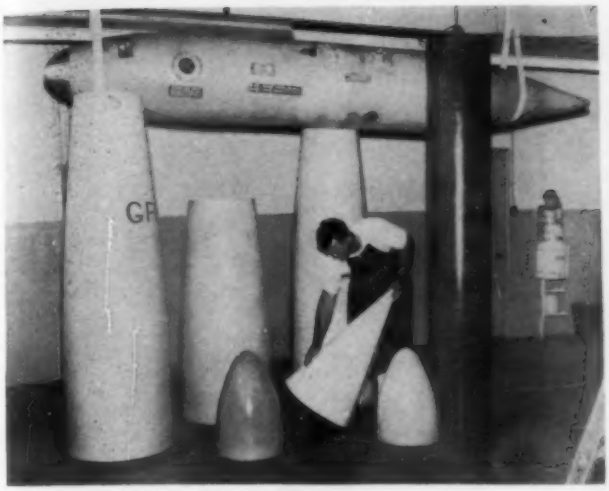


Fig. 4. Some typical shapes made with the GFR Process.

from the mold by utilizing rubber suction cups on pneumatically activated arms and a hoist (Figure II).

Parts have been molded as thin as 0.064 ± 0.010-inch, and as thick as 0.5-inch ± 10%. As yet, there has been no call to refine the tolerances at these ranges. Our only close tolerance requirements so far have been on radomes which required correction by grinding to ± 0.005-inch, and on radome blanks utilizing varied methods of correcting the boresight error of radomes which have been developed by various aircraft companies. It is not the writer's intent to dwell on these. It is important, however, to remember that a radome of initial phase uniformity may be corrected much more quickly than solid-laminate radomes made by conventional methods.

Conclusions

We feel our GFR process and organization can contribute a small share in reducing raw material costs by providing a producibility potential greater than press molded mat laminates, yet with the more uniform mechanical properties of a bag laminating process. GFR can produce a dollar volume by area comparable to a press shop, yet operate with much less expensive equipment and labor. It is not a panacea for all the drawbacks of other processes, but it can produce a wide

Fig. 5. Close-up of GFR Carousel, showing components.

variety of useful shapes.

It will not withstand burst pressures of filament windings nor equal the cloth laminates in all their stress properties, but it can fulfill a broad purpose which will help the industry's over-all picture. We intend to tread lightly and step cautiously into usages of other than the general-purpose polyester resins now perfected on the GFR process.

At present, we are experimenting with TAC resins in an effort to improve the process for higher temperature service parts. Tests also are being run to evaluate our potential for radome manufacture, utilizing various resins for proper stress at high temperatures and checking the stability and uniformity of their glass-resin ratios and their loss tangency and dielectric properties. Product development other than that of droppable fuel tanks, water softener tanks, shipping containers, radomes, and naval flotation gear must await future interest displayed by industry.

—The End

Laaff Joins Editorial Board

George S. Laaff, manager of research and development for Bolta Products Division, General Tire & Rubber Co., Lawrence, Mass., has joined the Editorial Advisory Board of PLASTICS TECHNOLOGY. He will be the advisory member on plastic film and sheet processing, replacing John Bolton, Jr., on the Board. Mr. Bolton, former general production manager for Bolta Products, resigned from the Board because his recent promotion to new executive duties with General Tire has removed him from the technological side of film and sheet processing.

Mr. Laaff was born in Cologne, Rhine, Germany, in 1908. He attended Hunboldt Gymnasium and Cologne University, receiving a B.S. in 1929 from the latter. He joined General Electric Co. in 1931, as a product engineer in the plastics department. In 1946, he was named research director to The Bolta Co. With the purchase of that firm by General Tire in 1954, he assumed his present position. Mr. Laaff is a member of SPE, SPI, ASTM, ACS, the National Association of Corrosion Engineers, and the American Association of Textile Chemists and Colorists. He resides in Andover, Mass., with his wife and three children.

High-Pressure Seals and Closures

(Continued from page 114)

block, rupture disc, 2¼-inch diameter packing ring of Teflon, and beveled retaining ring, was installed in the pressure side of an autoclave bottom cover, as shown in Figures 5 and 6. The initial seal was made by applying torque to the retaining ring with one-hand pressure on a six-inch spanner wrench, and the high-pressure seal was made by increasing the internal pressure in the autoclave. This is another example of the self-sealing principle.

The same packing ring principle was used in sealing the 1¼-inch diameter rupture disc in 110 consecutive experiments. With each experiment, the pressures alternated from 20 inches of vacuum to 6,000 psi., and temperatures alternated from 15-200° C. This type of closure, with a solid block instead of shear block and rupture disc, also was used successfully in the hydrostatic-pressure testing of the autoclave at 22,500 psi.

Because of the self-sealing design principle employed in the manufacture of Teflon packing-ring closures, it should be feasible to seal rupture discs of any diameter. All hold-up volume over the rupture disc can be eliminated by use of an "inverted hat" rupture-disc design.

Low-pressure rupture discs can be made from sheets of Teflon, or from Teflon-faced metal. The high softening temperature and chemical inertness of the material are the determining factors. —THE END

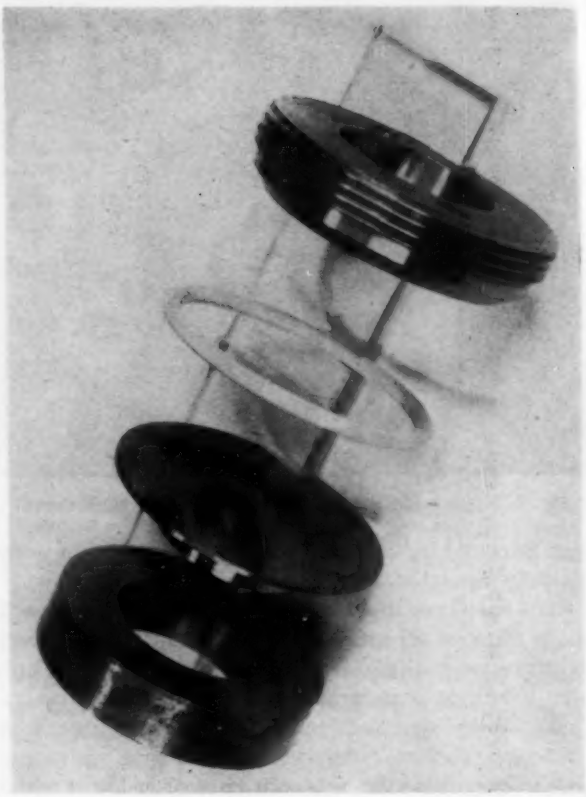


Fig. 6. Exploded view of rupture-disc closure assembly.

Polyethylene Insulates Submarine Cable

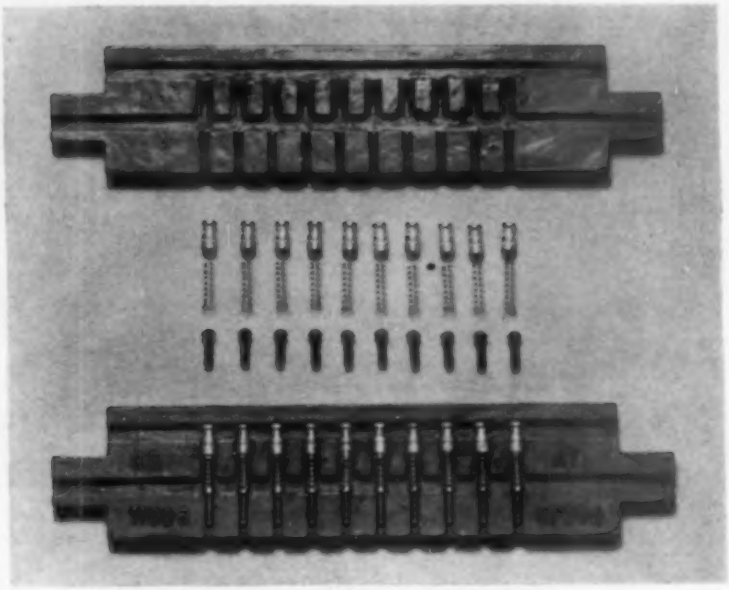
HM Telegraph Ship Monarch, set to lay cable between Scotland and Newfoundland.

SUBMARINE cable laying reached a new peak with the completion of the $40-million dual telephone line between Scotland and Newfoundland, and the AT&T cable from the State of Washington to Alaska. The North Atlantic cable is a joint venture of American Telephone & Telegraph Co., the British Post Office, and the Canadian Overseas Telecommunications Corp. Simplex Wire & Cable Co., Cambridge, Mass., contributed about 350 miles of shallow-water cable, and armored the more than 100 repeaters involved in the crossing.

HM Telegraph Ship "Monarch" layed the cable. Depicted in the accompanying photo, it is the only ship capable of laying the whole deep-water part of the cable in a single operation. About 5,000-6,000 tons of cable were needed for the span. Flexible amplifiers or repeaters were built into the cable, so that it could be laid without stopping the ship.

Bakelite's polyethylene was specified as the inner insulating material in both instances. Polyethylene's low electrical loss, low moisture absorption, and stability made it an ideal material for the application. It was extruded directly on the conductor, a solid copper wire over which three copper tapes were wrapped. The coated conductor was then passed through three cooling troughs, regulated to insure proper cooling, and taken up on large reels in 25,000-foot lengths. Outer wrappings include copper tapes, jute, and galvanized steel armor wire.

Repeaters occur each 37 nautical miles, and contain more than 60 components to amplify the signals as they pass along the cable. They are mounted inside 17 plastic cylinders, which are surrounded by two layers of steel rings. This enables them to withstand sea-bottom pressures of about 6,000 psi. Repeater inserts measure about 150 feet in length. —THE END



Glass-polyester fixture (top) used to hold metal parts (center) under compression (bottom) during soldering of the metal contact-assembly parts.

Glass–Polyester Soldering Fixture Gives Improved Service

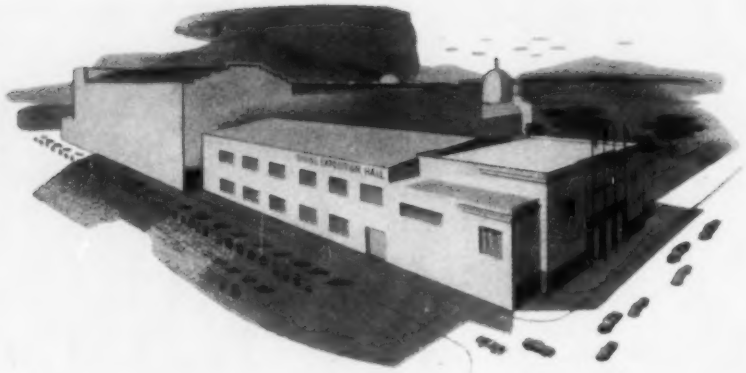
A GLASS-REINFORCED polyester plastic fixture for the assembly of small metal parts under compression has far exceeded in durability and stamina any fixture previously used for such production. Molded by Duralastic Products Co., Detroit, Mich., for the Schaefer plant of Burroughs Corp., the fixtures are used to hold together three small metal parts while they are being soldered in a Lepel high-frequency heater. When soldered, the metal assembly is a plunger-type electrical contact with varied uses.

The fixture was originally made from a phenolic cloth laminate which suffered from high piece cost and a service life of only 3-4 weeks before becoming too charred at the corners for further use. A year ago, Duralastic molded a preliminary order of fixtures from its Duramix polyester-glass premix. The order was placed by Burroughs in the hope that the saving in unit cost of the fixtures would more than compensate for the cost of the beryllium copper molds needed to make the fixture in Duramix. Burroughs ordered 400 of these fixtures in the expectation that this number would meet current production requirements, assuming a 3-4 week life per fixture. Substantial savings on reorders of the fixture were anticipated, since the die was paid for in the initial order.

In the soldering operation, the fixture and the metal parts are heated in a high-frequency field at temperatures up to 600° F., then the fixture is dropped in chlorothene to reduce the temperature of the soldered assemblies and to wash off the rosin soldering flux. The premix formula was compounded with Stypol 25 polyester resin, made by H. H. Robertson Co., reinforced with half-inch chopped glass fibers, made by Owens-Corning Fiberglas Corp. The heat distortion point of Stypol 25, which is 500° F., was raised an additional 120° by a method developed in the Duralastic laboratory by J. N. Epel, president, and C. J. Hamner.

After a full year of use, none of the Duralastic fixtures have shown any sign of the deterioration that affected the fabric-phenolic units previously employed. More than one million electrical contacts have been soldered in the polyester fixtures without breakage. On the basis of the year's production run, the Duralastic fixture appears to have a comparative usefulness at least 12 times that of the phenolic-cloth units, according to Dr. Epel. Burroughs has indicated their complete satisfaction with the new fixture's performance, and expects to use this type of fixture for future production jobs.

—THE END



Pacific Coast Plastics Exposition

The first Pacific Coast Plastics Exposition, sponsored by the Society of the Plastics Industry, Inc., will be held on March 18-21 at the Shrine Exposition Hall, Los Angeles, Calif., in conjunction with the Society's 1957 Annual National Conference (see page xx).

The Exposition, which is not open to the general public, will cover two floors of the Hall (main floor and balcony floor) and feature the exhibits of more than 80 companies in the plastics and supplier industries. The show will be open from 1:00-6:00 p.m. on March 18 and 20; from 1:00-10:00 p.m. on March 19; and from 1:00-5:00 p.m. on March 21, the final day. The Conference will be held at the Hotel Biltmore, Los Angeles, with sessions on each of the four mornings.

J. Allen Carmien, Nupla Mfg. Co., is general chairman of the committee for both the Exposition and Conference, with J. Redman, also of Nupla, as his assistant. K. R. Mergen, Crest Molded Products, Inc., is chairman of the Exposition subcommittee of 18 men; W. J. Ambersley, E. I. du Pont de Nemours & Co., is chairman of the housing subcommittee; and H. C. Millerburg, Loven Chemical of Calif., heads the reception subcommittee.

While PLASTICS TECHNOLOGY will not be exhibiting at the Exposition, we are printing this special feature section to assist our readers in planning their visit to the show. This section includes a statement by Mr. Carmien; floor plans of the exhibit areas; an alphabetical list of the exhibitors; a classfied list of the exhibits to be shown; and the program for the Conference.

Plastics on the Pacific Coast

J. ALLEN CARMIEN
President, Nupla Mfg. Co., Los Angeles, Calif.
General Committee Chairman, Pacific Coast Plastics Exposition
and SPI 1957 Annual National Conference

The year just ended was a significant one for the plastics in the West.

The growing number of businesses in the plastics industry on the Pacific Coast was reflected in the completion and planning of great new sources of raw materials to feed them. Carbide and Carbon Chemical Co. brought its polyethylene plant in Torrance, Calif., up to full-scale production in November, with an annual production of 60-million pounds.

A few days later, Union Oil Co. of Calif., announced that its subsidiary, Brea Chemicals, Inc., would enter a joint venture with Koppers Co. to manufacture another 60-million pounds of polyethylene per year. Other companies producing styrene, phenolic and vinyl resins, also indicated awareness of the growing consumer and industrial demand for plastics on the West Coast by laying long-range plans for concerted attention to this important market.

Great new uses were announced for plastics; uses where plastics are not "ersatz" or substitutes, but the most superior for the end-user. Certain plastics used in airplanes withstand heat better than titanium, the wonder metal. Because plastics do not have the heat-transfer problem of metals, air frame manufacturers are thinking of making the entire front section of airplanes from plastics. The plastics radome already is a big part of the airplane's nose.

The most dramatic proof that the plastics industry in the West has arrived came in early last autumn when the Society of the Plastics Industry announced it would hold its National Annual Conference in conjunction with the Pacific Coast Plastics Exposition. The concurrent events will be held in Los Angeles from March 18 to 21, marking the first time SPI has so recognized and honored its western members.

The West obviously will play a big part in making the wonderful world of plastics, "The Dynamic World of Plastics."

—THE END

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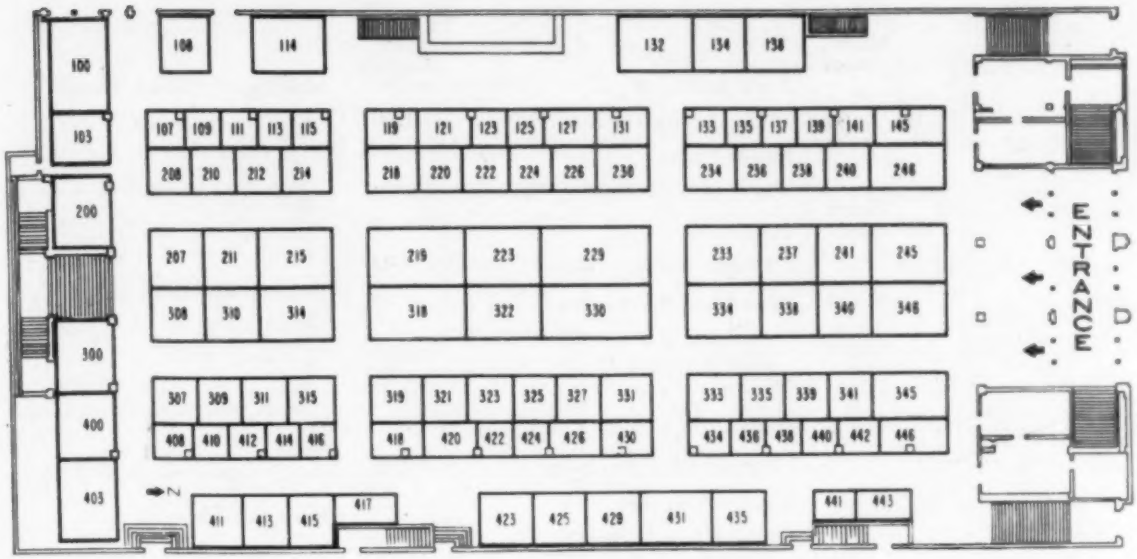
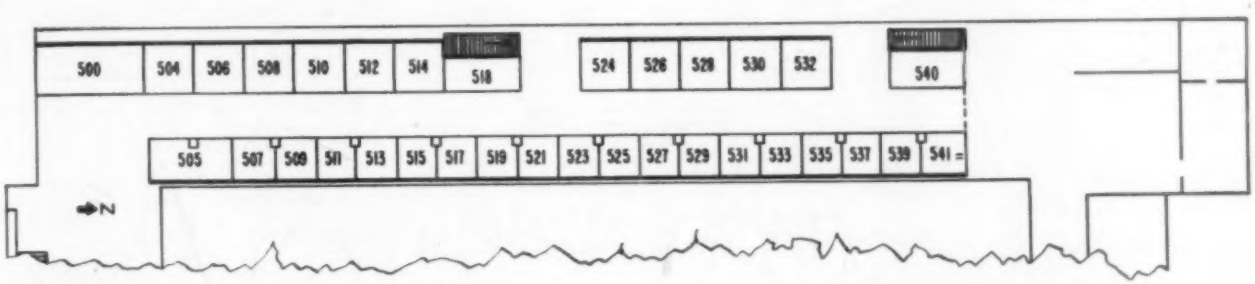
Statement by Exposition and Conference chairman, J. A. Carmien 126
Floor plans for exhibit areas 127
Alphabetical list of exhibitors 127
Classified list of exhibits 128
Program for SPI 1957 Annual National Conference 132

First Floor of Exhibit Area



Mezzanine Floor



Alphabetical List of Exhibitors

	Booth Numbers
aaRBee Plastic Co.	436
Aerojet Engineering Corp.	131
American Cyanamid Co.	218, 119
American Plastic Pipe Corp.	208
Automatic Molding Machine Co.	108
Avery Adhesive Label Corp.	123-125
Bakelite Co.	308-310, 314
Barrett Division, Allied Chemical & Dye Corp.	300, 400
Blackman Plastics Co.	440
Brea Chemicals, Inc.	215
Caco, Inc.	325
Cadillac Plastic Co.	234
Catalin Corp. of America	403
Celanese Corp. of America	334
Cerro de Pasco Corp.	246
Ciba Co., Inc.	322
Coast Mfg. & Supply Co.	214
Crowl, Charles, Co.	115
Danielson Mfg. Co., The	114
Dexter, C. H., & Sons, Inc.	237
Douglas Aircraft Co., Inc.	210
Dow Chemical Co., The	307-311
du Pont, E. I., de Nemours & Co., Inc.	346
Durez Plastics Division, Hooker Electrochemical Co.	333-335
E-F Decor Division, Einson Freeman Co., Inc.	438
Eastman Chemical Products, Inc.	229-230
Erie Engine & Mfg. Co.	139
Fellows Gear Shaper Co., The	100
Ferro Corp.	422-424
Fibercast Corp.	107
Firestone Plastics Co.	223
Flexfirm Products	412
Furane Plastics, Inc.	137
General Plastics Corp.	417
Grace, W. R., & Co., Polymer Chemicals Division	212
Harchem Division, Wallace & Tiernan, Inc.	341
Hercules Powder Co.	327
Hollywood Plastic Arts, Inc.	430
Hughes Aircraft Co.	429
Improved Machinery, Inc.	431-435
"Industrial News"	416
Industrial Research Laboratories	426
Instron Engineering Corp.	109-111
International Balsa Corp.	410
Jones-Dabney Co.	434
Koppers Co., Inc.	330
Larc Products, Inc.	127
Lee Deane Products, Inc.	238
Loven Chemical of California	319
Machinery Sales Co.	219
Mesa Plastics Co.	135
"Modern Plastics"	339
Monsanto Chemical Co.	207-211
Narmco, Inc.	423-425
New Hermes Engraving Machine Corp.	113
New Plastic Corp.	315
Olympic Plastics Co., Inc.	418
Oronite Chemical	103
Phillips Chemical Co.	318
Pastushin Aviation Corp.	121
Plastic Process Co.	240
"Plastics World"	443
Rainville Co., The	411-415
Reed-Prentice Corp.	134-138
Reichhold Chemicals, Inc.	338-340
Reinhold Engineering & Plastics Co.	222
Resistoflex Corp.	236
Revell, Inc.	241
Roberts, Ned L.	220
Rohm & Haas Co.	345
Shell Chemical Corp.	441
Sierra Electric Corp.	224
Swedlow Plastics Co.	331
Symons, Ralph B., Associates, Inc.	408
Thalco	321
U. S. Industrial Chemicals Co.	200
Van Dorn Iron Works Co., The	233
Wasco Products, Inc.	245
West Coast Plastics Distributors, Inc.	420
"Western Plastics"	442
Wheelco Instruments Division, Barber Colman Co.	446
Windsor, R. H., Ltd.	132
Zenith Plastics Co.	145

Classified List of Exhibits

Acrylics

	Booth Numbers
du Pont, E. I., de Nemours & Co., Inc.	346
Rohm & Haas Co.	345

Adhesives

	Booth Numbers
Monsanto Chemical Co.	207-211
Narmco, Inc.	423-425

Alkyds

	Booth Numbers
American Cyanamid Co.	218, 119
Barrett Division, Allied Chemical & Dye Corp.	300, 400
Reichhold Chemicals, Inc.	338-340

Allyls

	Booth Numbers
Mesa Plastics Co.	135
Balsa Core Materials	
International Balsa Corp.	410

Cellulosics

	Booth Numbers
Celanese Corp. of America	334
Dow Chemical Co., The	307-311
du Pont, E. I., de Nemours & Co., Inc.	346
Eastman Chemical Products, Inc.	229-230
Hercules Powder Co.	327

Coating

	Booth Numbers
Flexfirm Products	412

Casting

	Booth Numbers
Cadillac Plastic Co.	234

Colorants

	Booth Numbers
Ferro Corp.	422-424

Compression Presses

	Booth Numbers
Automatic Molding Machine Co.	108
Erie Engine & Mfg. Co.	139
Improved Machinery, Inc.	431-435
Symons, Ralph B., Associates, Inc.	408

Convertors (Film & Sheet)

	Booth Numbers
Coast Mfg. & Supply Co.	214
Firstone Plastics Co.	223

Epoxies

	Booth Numbers
Bakelite Co.	308, 310, 314
Ciba Co., Inc.	322
Coast Mfg. & Supply Co.	214
Furane Plastics, Inc.	137
Jones-Dabney Co.	434
Shell Chemical Corp.	441

Extruders, Extruder Accessories

	Booth Numbers
Industrial Research Laboratories	426
Machinery Sales Co.	219
Reed-Prentice Corp.	134-138
Windsor, R. H., Ltd.	132

Fabricated Products

	Booth Numbers
Coast Mfg. & Supply Co.	214
General Plastics Corp.	417
Plastic Process Co.	240
Resistoflex Corp.	236
Revell, Inc.	241
Sierra Electric Corp.	224
Wasco Products, Inc.	245

Film, Sheets, Shapes

	Booth Numbers
Bakelite Co.	308-310, 314
Cadillac Plastic Co.	234
Celanese Corp. of America	334
Coast Mfg. & Supply Co.	214
Dow Chemical Co., The	307-311
du Pont, E. I., de Nemours & Co., Inc.	346
Firestone Plastics Co.	223
Monsanto Chemical Co.	207-211
Rohm & Haas Co.	345

Finishing, Custom

	Booth Numbers
Crowl, Charles, Co.	115

Fluorocarbons

	Booth Numbers
Bakelite Co.	308-310, 314
du Pont, E. I., de Nemours & Co., Inc.	346

Foam Equipment

	Booth Numbers
Rainville Co., The	411-415

Foamed Plastics

	Booth Numbers
Dow Chemical Co., The	307-311

Furanes

	Booth Numbers
Furane Plastics Inc.	137

Glass Mats, Fabrics, Etc.

	Booth Numbers
Coast Mfg. & Supply Co.	214
Ferro Corp.	422-424
Flexfirm Products	412
Thalco	321

Grinders

	Booth Numbers
Rainville Co., The	411-415

Injection Machines

	Booth Numbers
Fellows Gear Shaper Co., The	100
Improved Machinery, Inc.	431-435
Rainville Co., The	411-415
Reed-Prentice Corp.	134-138
Symons, Ralph B., Associates, Inc.	408
Windsor, R. H., Ltd.	132

Injection Machine Accessories

	Booth Numbers
Rainville Co., The	411-415

Labels

	Booth Numbers
Avery Adhesive Label Corp.	123-125

Laminating

	Booth Numbers
General Plastics Corp.	417
Olympic Plastics Co., Inc.	418
Reinhold Engineering & Plastics Co.	222
Resistoflex Corp.	236
Swedlow Plastics Co.	331

Marking Equipment

	Booth Numbers
New Hermes Engraving Machine Corp.	113

Melamines

	Booth Numbers
American Cyanamid Co.	218, 119
Barrett Division, Allied Chemical & Dye Corp.	300, 400
Catalin Corp. of America	403
Monsanto Chemical Co.	207-211

Metallizing

	Booth Numbers
Crowl, Charles, Co.	115

Mills

	Booth Numbers
Erie Engine & Mfg. Co.	139

Mixers

	Booth Numbers
Symons, Ralph B., Associates, Inc.	408

Molding, Blow

	Booth Numbers
Cadillac Plastic Co.	234

Molding, Cold

	Booth Numbers
Cadillac Plastic Co.	234
Sierra Electric Corp.	224

Molding, Extrusion

	Booth Numbers
Cadillac Plastic Co.	234
Danielson Mfg. Co., The	114
General Plastics Corp.	417
Plastic Process Co.	240
Resistoflex Corp.	236
Van Dorn Iron Works Co., The	233

Molding, Injection

	Booth Numbers
aaRBee Plastic Co.	436
Danielson Mfg. Co., The	114
New Plastic Corp.	315
Olympic Plastics Co., Inc.	418
Reinhold Engineering & Plastics Co.	222
Revell, Inc.	241
Van Dorn Iron Works Co., The	233

Molding, Reinforced Plastics

	Booth Numbers
Cadillac Plastic Co.	234
Fibercast Corp.	107
Lee Deane Products, Inc.	238
Olympic Plastics Co., Inc.	418
Pastushin Aviation Corp.	121
Resistoflex Corp.	236
Sierra Electric Corp.	224
Swedlow Plastics Co.	331
Zenith Plastics Co.	145

Molding, Thermoset

	Booth Numbers
Blackman Plastics Co.	440
Danielson Mfg. Co., The	114
Lee Deane Products, Inc.	238
Olympic Plastics Co., Inc.	418
Reinhold Engineering & Plastics Co.	222
Sierra Electric Corp.	224

Molds

	Booth Numbers
Caco, Inc.	325

Paper Specialties

	Booth Numbers
Dexter, C. H., & Sons, Inc.	237

Patterns, Epoxy

	Booth Numbers
Cerro de Pasco Corp.	246

Phenolics

	Booth Numbers
Bakelite Co.	308-310, 314
Barrett Division, Allied Chemical & Dye Corp.	300, 400
Catalin Corp. of America	403
Coast Mfg. & Supply Co.	214
Durez Plastics Division, Hooker Electrochemical Co.	333-335
Loven Chemical of California	319
Monsanto Chemical Co.	207-211
Reichhold Chemicals, Inc.	338-340

Plastic Pipe

	Booth Numbers
American Plastic Pipe Corp.	208
Fibercast Corp.	107

Plasticizers

	Booth Numbers
Harchem Division, Wallace & Tiernan, Inc.	341

Polyamides

	Booth Numbers
Barrett Division, Allied Chemical & Dye Corp.	300, 400
du Pont, E. I., de Nemours & Co., Inc.	346

Polyesters

	Booth Numbers
American Cyanamid Co.	218, 119
Bakelite Co.	308-310, 314
Barrett Division, Allied Chemical & Dye Corp.	300, 400
Celanese Corp of America	334
Coast Mfg. & Supply Co.	214
Flexfirm Products	412
Loven Chemical of California	319
Reichhold Chemicals, Inc.	338-340
Rohm & Haas Co.	345

Polyethylenes

	Booth Numbers
Bakelite Co.	308-310, 314
Barrett Division, Allied Chemical & Dye Corp.	300, 400
Brea Chemicals, Inc.	215
Celanese Corp. of America	334
Dow Chemical Co., The	307-311
du Pont, E. I., de Nemours & Co., Inc.	346
Eastman Chemical Products, Inc.	229-230
Grace, W. R., & Co., Polymer Chemicals Div.	212
Hercules Powder Co.	327
Koppers Co., Inc.	330
Monsanto Chemical Co.	207-211
Phillips Chemical Co.	318
U. S. Industrial Chemicals Co.	200

Preform Equipment

	Booth Numbers
Erie Engine & Mfg. Co.	139

Press Accessories

	Booth Numbers
Rainville Co., The	411-415

Saws

	Booth Numbers
Rainville Co., The	411-415

	Booth Numbers
Silicones	
Bakelite Co.	308-310, 314
Barrett Division, Allied Chemical & Dye Corp.	300, 400
Structural Plastics	
Aerojet Engineering Corp.	131
Douglas Aircraft Co., Inc.	210
Hughes Aircraft Co.	429
Narmco, Inc.	423-425
Pastushin Aviation Corp.	121
Zenith Plastics Co.	145
Styrenes & Copolymers	
Bakelite Co.	308-310, 314
Catalin Corp. of America	403
Dow Chemical Co., The	307-311
Firestone Plastics Co.	223
Koppers Co., Inc.	330
Monsanto Chemical Co.	207-211
Temperature Controllers	
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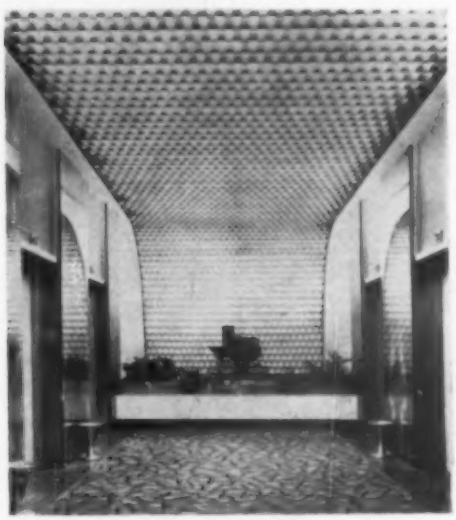
Plexiglas Illumination Scores Again



Plexiglas ceiling in a basket-weave pattern illuminates Dallas hotel lobby.

THE recently-opened Statler Hotel in Dallas, Tex., includes many new lighting concepts, the majority of which employ Plexiglas, Rohm & Haas Co.'s acrylic resin. Translucent white, colored, patterned, and clear materials are used to create various effects such as basket weaves, glowing dots, abstract art, and shatter-resistant fixtures. Custom forming for various complex structures was done by Solar Plastics Products, Inc., Brooklyn, N. Y.

Perhaps the most unusual approach to illumination is the basket-weave ceiling and end-wall of the elevator lobby (see accompanying photograph). The 40 by 8-foot sweep combines texture with soft white light, and blends gracefully with the simple lines of the lobby. Two-inch strips of ⅛-inch thick acrylic, translucent white, are preformed and woven around ovoid brass bars spaced at six-inch intervals. Bar ends are supported by steel channels fabricated in three-foot sections which are invisibly joined at the top. Each section is supported on wires, and can be lowered for fluorescent tube replacement.

Acrylic joints are cemented at points where they pass over the brass rods, making them invisible from below. Three by four-foot sheets of ripple-patterned Plexiglas are mounted between the woven strips to hide the actual lighting fixtures. The map of Texas, measuring about 2½ feet across, was cut from ¾-inch, smoke-gray translucent sheet. A back-lighted star fabricated in clear acrylic indicates the location of Dallas.

Almost 1,700 clear and colored acrylic buttons are inserted in the stainless steel panels of the elevators. Back-lighting furnishes the actual illumination. Abstract art, consisting of vari-colored Plexiglas strips and squares, adds interest to the ceiling over the registration desk. Acrylic shades are used to diffuse the lights in the guest room closets.

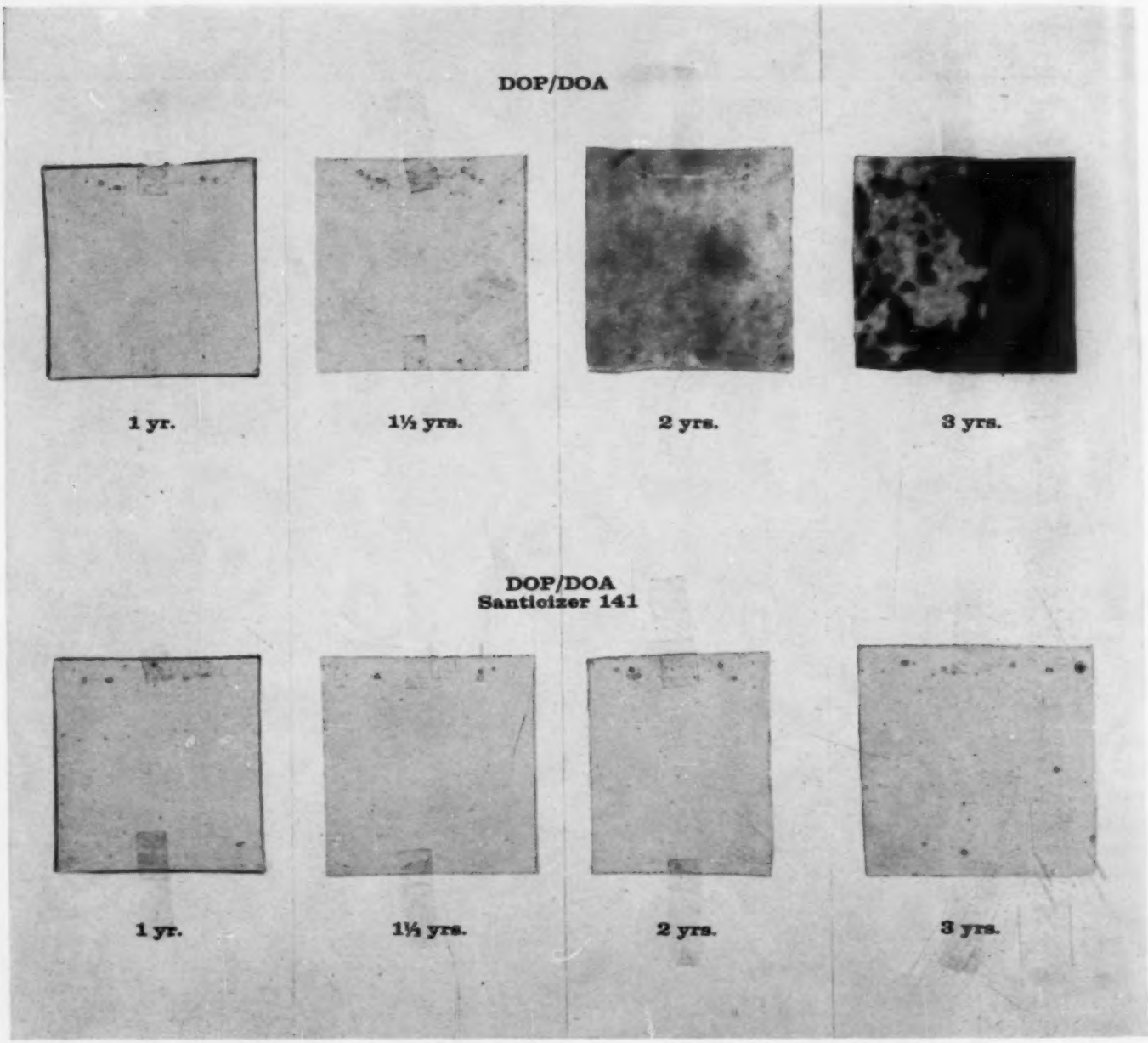
—THE END

Low-cost light stability

Across-the-board approval for non-toxicity

Higher tear strength and flame retardance

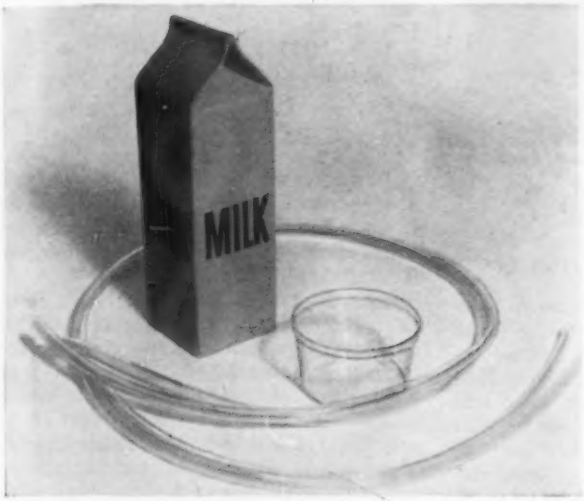
ONLY SANTICIZER 141 GIVES Y

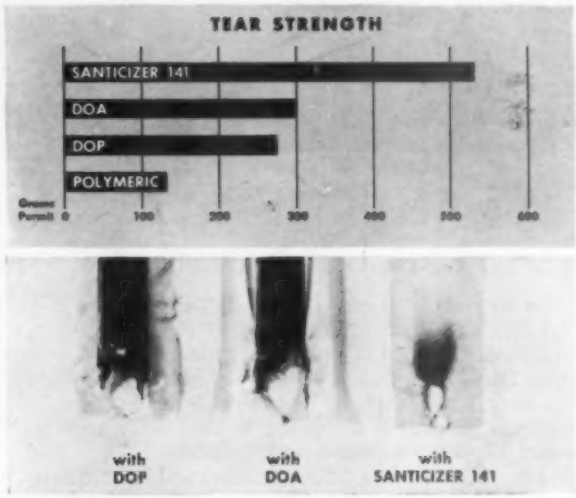


1. Low-cost light stability

These samples from a 3-year outdoor exposure study show the excellent light stability that is inherent in Santicizer 141. Control compounds (40-mil sheeting) plasticized with a blend of DOP and DOA began to fail in slightly over one year. Experimental samples in which five parts of Santicizer 141 replaced five parts of DOP show no visible deterioration even after two years of severe St. Louis climatic conditions—with only slight degradation after three years. Yet Santicizer 141 is a low-cost primary plasticizer!

YOU ALL THESE ADVANTAGES





2. Across-the-board approval for non-toxicity

If you're interested in the food packaging, tubing, and surgical supplies market, here's a valuable fact: Santicizer 141 meets the requirements of both the Food and Drug Administration and the Bureau of Animal Industry. Because Santicizer 141 has this across-the-board approval, you can use it for food packaging and plastic products intended for close contact with animal or human bodies.

3. Higher tear strength and flame retardance

Films plasticized with Santicizer 141 may have as much as *double* the tear strength of those plasticized with straight DOP. Santicizer 141 also imparts superior low-temperature flexibility, resistance to embrittlement on aging. And it has excellent flame-retarding properties: flame-out time is only three seconds for polyvinyl chloride plasticized with Santicizer 141 at 50 parts per 100 parts of resin.

WANT TO IMPROVE ANY OF THESE PRODUCTS?

To improve the light stability of curtains, floor tile, films . . .

To improve the non-toxicity of plastic surgical supplies, tubing, food wrappings and containers . . .

To improve the tear resistance and flame retardance of belting, tapes, upholstery, rain wear . . .

Our Technical Service Department will help you test Santicizer 141 in your operation. Monsanto supplies almost FIFTY different plasticizers of SEVEN basic types. Call on Monsanto for one-stop service, mixed bulk shipments at bulk prices, and expert technical advice.

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With no vested interest in any single plasticizer, Monsanto develops plasticizing systems tailor-made to fit your needs.

SANTICIZER: Reg. U. S. Pat. Off.

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WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU

News of the Societies

Photo by, Edward H. Goldberger

SPE National Officers for 1957: (left to right) R. K. Gossett, secretary; J. W. Lindau, treasurer; P. W. Simmons, president; and H. S. Nathan, vice president.

SPE 1957 National Conference Features High Level of Papers

The thirteenth annual National Technical Conference of the Society of Plastics Engineers, Inc., held on January 16-18 in the Sheraton-Jefferson Hotel, St. Louis, Mo., was highlighted by the high level of papers presented, increasing participation by plastics companies, and a registration total of more than 1,800 members and guests. Sponsored by the SPE St. Louis Section, the Conference had as its theme "15 Years of Plastics Progress".

The technical program consisted of concurrent sessions on each of the three mornings and the afternoons of January 16 and 17. An educational symposium was held on the evening of January 16; the Conference Luncheon took place on January 16; and the annual Cocktail Party and President's Reception and the annual Banquet was held on January 17. In addition, there were numerous official committee meetings and luncheons, and a full program of activities for the ladies.

A total of 73 technical papers were presented at the Conference. The morning sessions on January 16 dealt with the subjects of atomics, design, and tooling and machinery. The afternoon sessions that day were devoted to extrusion—I, injection molding—I, and foams. On January 17, the morning sessions dealt with injection molding—II, extrusion—II, and applications, while the afternoon session subjects were reinforced plastics—I, instrumentation, compression molding, and research. The subjects of the final day's morning sessions were polyethylene, reinforced plastics—II, and epoxies.

National officers of the Society for 1957, elected by the National directors, were announced at the Conference Luncheon, as follows: president, Peter W. Simmons, Dow Chemical Co.; vice president, Haiman S. Nathan, Atlas Plastics, Inc.; secretary, R. Kenneth Gossett, Gossett & Hill Co.; and treasurer, Jules W. Lindau, Southern Plastics Co., Inc. The luncheon also featured a welcoming address by C. P. Briscoe, St. Louis Director of Public Utilities, pinch-hitting for Mayor Raymond Tucker; a brief talk by the outgoing national president Jerome L. Formo, Minneapolis-Honeywell Regulator Co.; reports by the various national committee chairmen; and an announcement that the first book in the Society's contemplated series of technical volumes has been published. This book is "Quality Control for Plastics Engineers," edited by L. M. Debing.

The after-dinner speaker at the Banquet was Joseph Holland, Pevely Dairy Co. and "Toastmaster of St. Louis," whose topic was "Past Imperfect—Future Tense." Other highlights of the banquet were the presentation of a plastic gavel to Mr. Formo; the introduction of the new national officers; and a talk by Mr. Simmons on the Society's plans for the coming year.

Arrangements for the Conference were handled by a 21-man committee set up by the St. Louis Section. Otto Wulfert, Wagner Electric Corp., was chairman of the committee, with W. J. Stephens, Carpenter Steel Co., as co-chairman, W. P. Bussart, Eastman Chemical Co., as secretary, and A. G. Werner, manufacturers' agent, as treasurer.

SPI 1957 Annual Conference

The 1957 Annual National Conference of the Society of the Plastics Industry, Inc., will be held on March 18-21 at the Hotel Biltmore, Los Angeles, Calif. This event will mark the first time that the Conference has been held on the Pacific Coast, and reflects recognition of the fact that the greater Los Angeles area now is the third largest industrial area in the United States and, as such, is an important area for the domestic plastics industry.

The Conference will consist of daily morning sessions, so that registrants can visit the Pacific Coast Plastics Exposition, open each afternoon, at the Shrine Exposition Hall in Los Angeles.

John Delmonte, Furane Plastics, Inc., is chairman of the program committee, which consists of 23 representatives of SPI member companies in the Pacific Coast area.

The program for the Conference follows:

Monday, March 18

9:30-10:00 a.m.—Business meeting of SPI Pacific Coast Section.

10:00-10:30 a.m.—SPI national business meeting.

10:30-11:15 a.m.—Keynote address by Robert Prescott, president, Flying Tiger Lines.

Tuesday, March 19

Two concurrent sessions from 9:30-12:00 a.m. Session I, "Plastics in Aircraft and Defense," will consist of the five papers which follow: "Reinforced Plastics for Rocket Applications," G. Epstein, J. W. Eberhardt, J. Goldberg, and H. A. King, all of Aerojet-General Corp.; "Self-Expanding Polystyrene Foam—A New Low Density Molding Material," speaker from Dow Chemical Co.; "Fiberglass for Missile Usage," W. J. Schnorr, L. W. Eccleston, and T. E. Holdridge, all of Hughes Weapon Systems Development Laboratories; "New Epoxy Resins for Reinforced Plastics," E. W. Kummel, P. A. Thomas, and J. L. Welch, all of Bakelite Co.; and "Filament Wound Structures," R. Noland, Reinhold Engineering & Plastics Co.

Session II, on "Plastics in Consumer Goods—Housewares, Toys and Hobbies," will consist of five papers: "Special Applications of Linear Polyethylene," speaker from Celanese Corp. of America; "Design Trends in Plastics Housewares," James Kelson, Packard-Bell Co.; "Hobby Merchandise—A 'Cadillac' Plastics Application," L. H. Glaser, Revell, Inc.; "Merchandising and Growth Problems of the Industry as a Whole," J. M. Jayne, Plas-Tex Corp.; and "What Should be the Function of Raw Material Suppliers in Helping Expand the Markets of Plastic Consumer Goods Manufacturers?" panel discussion.

The luncheon speaker will be Brig. General Thomas Bryan, commander of Wright Air Development Center.

Wednesday, March 20

There will be two concurrent morning sessions from 9:00-12:00 a.m. The first session, on "Plastics in the Electrical and Electronic Industries," will consist of five papers: "Evaluation Tests for Epoxy Casting Systems," M. V. Goodyear and J. P. Hornburg, both of Houghton Laboratories; "Epoxy Casting Resins for Electrical Applications," W. E. Weber, Hughes Aircraft Co.; "Plastics and Electrical Application Military Requirements," J. B. Alfers, Navy Bureau of Ships; "Insulating Values of Plastics and Requirements in Electrical Materials," W. Sumner, NEMA general

engineering committee; and "Linear Polyethylene and Chlorinated Polyether—Two New Raw Materials for the Electrical Insulating Industry," E. W. Cronin, Hercules Powder Co.

The second session will deal with "Plastics in the Chemical Process and Related Industries," and include four papers and two panel discussions. John Marzicola, Zenith Plastics Corp., will speak on "Plastics in Marine Fields," and H. E. Pinches, Dept. of Agriculture, and C. E. Staff, Bakelite Co., will present a paper on "Plastics in the Agricultural Industry." The subjects of these two papers will be discussed by a panel composed of the authors and John Alfers, Navy Bureau of Ships; D. Richman, Paradise Pools; L. N. McClellan, Bureau of Reclamation; K. L. Edgar, Firestone Plastics Co.; E. Brink, Food Machinery & Chemical Corp.; J. Boldwin, Brea Chemicals, Inc.; W. Hess, Anesite Co.; M. Carr, Fiberlay Corp.; E. D. Horne, Wizard Boats; and E. White, Thalco, Inc.

The remaining two papers of this session are: "Chemical Properties of Plastics in the Petroleum and Process Industries," R. B. Seymour, Loven Chemical; and "An Oil Company Purchasing Agent Looks at Plastics," C. W. Perkins, Union Oil Co. These papers will be followed by a panel discussion of the subjects covered. In addition to the above authors, the panel members will be D. Boggs, National Tube Co.; H. Dague, Collins, Caldwell & Dague; T. Stevenson, Sloane Mfg. Co.; A. Murmann, American Agile Corp.; H. Yackey, Suburban Water Co.; L. B. Crowley, Phillips Chemical Co.; C. Condit, SPI; W. Leahy, B. F. Goodrich Chemical Co.; L. Tallman, Dow Chemical Co.; W. O. Bracken, Hercules Powder Co.; and J. A. Shelton, E. I. du Pont de Nemours & Co.

Thursday, March 21

There will be two concurrent sessions from 9:30-12:00 a.m. Session I, on "Plastics in Packaging," will consist of the following five papers: "Dylite Polystyrene Foam—A New Concept in Packaging," E. A. Edberg, Koppers Co.; "Formed Cellulosics—Present Uses and Future Horizons for Packaging," W. M. Ronayne, Celanese Corp.; "Zytel Nylon for Packaging," W. M. Ryan, Du Pont; "Significant Factors in Plastic Container Fabrication," R. J. Lee, Dow Chemical Co.; and "The Role of Polyethylene in Creative Packaging and Successful Selling," J. R. Akers, Bakelite Co.

Session II, on "Plastics in the Field of Building Materials," will consist of the following talks: "House of the Future," R. P. Whittier, Monsanto Chemical Co.; "Status of Building Codes and Industry Approach to Problems," F. X. Ambrose, Alsynite Corp. of America; "Plastics in Structural Applications," A. Q. Jones, architect; "Plastics in Outdoor Landscaping Construction," G. Eckbo, Eckbo, Royston & Williams; "Opportunities for Plastics," G. Hermach, Architectural Plastics Corp.; and "Decorative Plastics in Interior Design," W. Fry, Fry Plastics Co.

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Please request tickets on your company letterhead, since there are no general public admissions.

Pacific Coast Plastics Exposition

March 18-21, 1957

Shrine Exposition Hall

Los Angeles, California

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The backfield we've assembled to call signals for GREX seems to spend *all* its time in motion. Right now, for instance, our slide-rule quarterbacks are galloping from one machine to another. They gaze at gauges, take pulse readings on extruders, peer at our injection molding machines. And everything they do is calculated to make the production and marketing of products based on this new high-density polyethylene, simpler and more profitable for you. It does take time, but *it is well worth the work—and the wait.*

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POLYMER CHEMICALS DIVISION
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News of the Industry

National Aniline's new isocyanates plant

Isocyanates Plant Opened

Start-up of the multi-million dollar isocyanates plant at Moundsville, W. Va., has been announced by National Aniline division, Allied Chemical & Dye Corp., New York, N. Y. Constructed in record time, the unit occupies more than 15 acres of the 210-acre site located on the Ohio River about 70 miles southwest of Pittsburgh.

The new plant is a completely integrated facility, with all chemical raw materials supplied within the Allied Chemical group. Louis C. Goode, recently appointed plant manager to succeed the late Ross M. Sims, will direct the operation. National Aniline markets isocyanates under the trade name Nacconates.

Develops Oxidation Process

A new process has been developed by Scientific Design Co., Inc., New York, N. Y., and an affiliated group of enterprises, whereby phthalic anhydride can be produced without using naphthalene, the traditional raw material. This is considered to be of particular importance, since more than 25% of the naphthalene used in the United States must be imported from abroad.

The process was discovered through an attempt to manufacture terephthalic acid from cheaper raw materials than para-xylene. Para - diisopropylbenzene, made from propylene and benzene, was directly oxidized with air to terephthalic acid, an intermediate used in the manufacture of polyesters. Other techniques were discovered for oxidizing various aromatics, including the xylenes, simply and directly with air to their respective dibasic acids.

Standard Oil Co. of Indiana, Chicago, Ill., has acquired world-wide exclusive rights to the process, and will manufacture the following chemicals: phthalic anhydride, isophthalic acid, terephthalic acid, dimethyl terephthalate, dimethyl isophthalate, and benzoic acid. Scientific Design has been engaged to design Standard's $10-million plant, which will be built in the Midwest. Amoco Chemicals Corp., a Standard subsidiary, will be the actual client.

Plant sites are currently under consideration, and actual construction work should be underway shortly. When completed, the plant will have a capacity of 60-million pounds per year. The long-range impact of this process is expected to equal that of the first discoveries in the aliphatic chemical industry, which produces vast quantities of ethylene, propylene, and butylene from petrochemicals. The aromatics would be used to produce plentiful and cheap intermediates for the manufacture of fibers, films, alkyds, polyesters, plasticizers, elastomers, and foams.

Plastic Wall Tile Promotion

Design 57, a preview of its Styron wall tile merchandising and market-development program, has been presented by Dow Chemical Co., Midland, Mich. Designed to point out how quality styrene tile can be employed throughout the home, the program follows up Dow's Certified Dealer-Guarantee Program of mid-1955.

Full-color pages of the new designs are to be concentrated in leading consumer and trade publications throughout 1957. A color brochure containing new promotional ideas, is available to dealers for local advertising, direct mail, and retail merchandising programs.

Acquires Chemical Plant Site

A 163-acre site near Carrollton, Ky., has been purchased by Metal & Thermit Corp., New York, N. Y., for the erection of a chemical processing plant. Initial construction will cover approximately 10 acres of the tract, and will include an office building, warehouse, steam plant, production buildings, and several minor structures. The facility will employ 30-35 persons at the outset.

The plant will produce organotin stabilizers, plus a complete line of color stabilizers for PVC resins and other plastics formulations. The latter includes tin stabilizers for plastic floor tile.

Reinforced plastic panel features imbedded curls of cedar wood. This is one of the model rooms at U. S. Rubber's new exhibit hall.

U. S. Rubber Promotion Plans

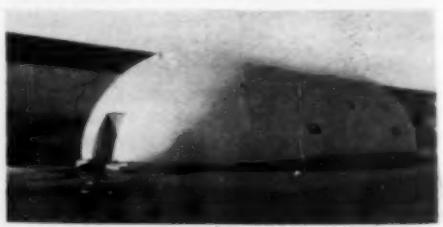
"Over $40-million will be spent during 1957 for expansion and modernization," according to H. E. Humphreys, Jr., president of United States Rubber Co. The statement was made at the November 26 preview of the firm's new exhibit hall in Rockefeller Center, New York City, which is expected to attract two million visitors a year.

The exhibit will enable the public to see the results of U. S. Rubber's expanding research program. More than 24 new products and new product lines have been introduced since 1948, each of which has reached a sales level of a million dollars or more per year. Their total contribution in 1956 is estimated at $100-million, and this figure is expected to double by 1960.

Portable Temporary Warehouse

A pneumatically supported edifice, known as the Airhouse, has been developed by United States Rubber Co., for manufacture and distribution by Calumet Industrial District Co., Chicago, Ill. Reportedly the answer to warehousemen's need for temporary storage space, the unit costs approximately ⅓ as much as a prefabricated metal building of comparable size.

The building is made of paper-thin, vinyl-coated nylon fabric called Fiberthin, a product of the coated fabrics department of U. S. Rubber's footwear and general products division, Mishawaka, Ind. Deflated, it folds into a package five feet long by three feet wide weighing about 400 pounds.



Inflated warehouse of vinyl-coated nylon.

The Airhouse is inflatable by means of a compressor or blower, and can be erected by three men in about an hour. Air pressure bulges the building upward and outward, and tension keeps the walls and roof taut. The dome-shaped structure measures 40 by 80 feet, and is 20 feet high. It is securely anchored to the ground by a Fiberthin tube 15 inches in diameter, which extends around the base and contains 23,000 pounds of water.

Flame-resistant and requiring practically no maintenance, the Airhouse is particularly suitable for food manufacturers who are constantly in need of seasonal, temporary storage for package goods during peak production months. The compressor maintains a constant stream of low-pressure air which enables the building to retain its shape even when the door is opened to permit entry of fork lift trucks. The air compressor also acts as an air-conditioning unit.

Escambia Opens PVC Plant

The new PVC resins plant of Escambia Chemical Corp., near Pensacola, Fla., has commenced commercial production. The first materials to be produced are of the general-purpose type, designed for use in calendering, extrusion, and molding. Developed at Escambia's Cambridge and Newton, Mass., plants, the resins are said to possess improved heat stability in processing. General headquarters and sales offices of the company are at 261 Madison Ave., New York City.

Sylvania Opens Plastics Plant

Manufacturing operations are under way at Sylvania Electric Products, Inc.'s new plastics plant in Warren, Pa. The multi-million dollar installation, utilizing the latest in molding and finishing equipment, will produce radio-tube bases and sockets, fluorescent lamp bases, wiring devices, and a variety of custom-molded plastic items for non-electronic industries.

The 110,000-square foot, single-story plant was erected by Lauter Construction Co., Philadelphia, Pa. Designed by Sylvania architects, it has a structural steel frame with brick facing. The manufacturing portion is composed of painted concrete block and aluminum to provide contrast. This same area contains a system of floor trenches for carrying both utilities and waste products, and an underfloor conveyor system transports molding flash to an exterior trash hopper.

Princeton Plastics Program

Princeton University's Graduate Plastics Program, and the opportunities for fellowships and assistantships within the program, have been outlined by Louis F. Rahm, director of the school's Plastics Laboratory. The course of study leads to the degree of Master of Science in Engineering, and includes both lecture and laboratory classes.

Instruction covers properties, evaluation, production, fabrication, design, and application of materials, as well as the chemistry of plastics. Applicants must hold a Bachelor's degree in engineering or physical science from a recognized institution, and must meet the general admission requirements of Princeton's Graduate School.

Fellowships with stipends of $1,500-2,100, plus tuition and fees, are available. Opportunities for employment as half-time research assistants at $1,800 per academic year are offered to students not on fellowships. Inquiries should be directed to Mr. Rahm, at 30 Charlton St., Princeton, N. J.

Goodyear Opens Radiation Lab

A fully equipped radiation laboratory, built at a cost of more than $125,000, has been opened by Goodyear Tire & Rubber Co., Akron, O. Using radioactive cobalt-60, the firm will investigate compounding practices and chemical additives in an effort to improve the radiation resistance of rubbers, and the physical properties of resins and plastics.

Goodyear's radiation source of cobalt 60 is shielded under water.

Nine cobalt-60 slugs, sheathed in 1/16-inch aluminum, are assembled in an aluminum pencil about 10 inches long. Goodyear's source consists of 72 of these pencils, and was activated in the NRX reactor, Chalk River, Ont., by Atomic Energy of Canada, Ltd. The laboratory itself is a ground-floor structure measuring 42 by 42 ft. A heavily-shielded area, known as the "cave", houses the radioactive source. It has four-foot reinforced concrete walls, and a three-foot ceiling. This shielding is adequate for an anticipated 10,000 curie source, or about 1,000,000 curies of the fission by-product, cesium-137, which also can be used in irradiation experiments.

The cobalt-60 source is kept in a concrete- and aluminum-lined well, containing 17 ft of water. An elevator within the well raises the source into an aluminum housing for experiments. Samples to be irradiated can be placed in the center of the housing for intense radiation, or throughout the "cave". This arrangement removes practically all limits on the size and number of samples which can be subjected to radiation at one time.

Offers Custom Castings

New high-speed, low-cost molding techniques for short runs have been developed by Telectro Industries Corp., Long Island City, N. Y. Advantages include the elimination of specially-designed tools and the subsequent elimination of lengthy tooling time.

Intricate sections reportedly can be cast in all manner of shapes and sizes. Tolerances of molded pieces can be held within 0.0005-inch, depending on size, and surfaces do not require finishing. Specially-formulated thermosetting compounds are available for all types of uses and applications.

Monsanto-Plax Joint Venture

The plastics division of Monsanto Chemical Co., Springfield, Mass., has entered into a distributorship agreement with Plax Corp., Hartford, Conn., to develop and expand U. S. markets for Plax's Polyflex 100 series film and sheeting. The agreement is mutually beneficial, in that Monsanto's vast sales and development organization will supplement the Plax sales staff, and Monsanto will be able to expand the range of products it offers.

Monsanto will enlarge its present sales force, which now handles Vuepak cellulose acetate base material, Lustrex styrene, Resinox phenolics, polyethylene, and Ultron vinyl film and sheeting. Polyflex 100 is a series of biaxially-oriented styrene sheet materials containing no plasticizers or stabilizers.

ADM Purchases GE Rights

Archer - Daniels - Midland Co., Minneapolis, Minn., has purchased the right to manufacture Glyptal alkyd resins from General Electric Co. The transaction includes GE's finished goods inventories, equipment, formulations, and manufacturing specifications from the Schenectady, N. Y., plant. This facility was destroyed by fire last March, and will not be rebuilt. GE will continue, however, to operate its resin plants in Anaheim, Calif., and Toronto, Ont.

Archer-Daniels-Midland will manufacture and sell the resins under its own brand names. Plants involved are ADM's Minneapolis, Los Angeles, Newark, and Toronto units. Among the personnel joining ADM are Fred J. Burnett, former Glyptal sales manager and new sales manager for industrial resins; and James R. Blegen, who becomes manager of the ADM industrial resins sales service laboratory in Minneapolis.

Establishes Research Group

Borden Co.'s chemical division, New York, N. Y., has established a forest products research group for the purpose of developing new resin and polymer products especially adapted to new applica-

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Wood flour is usually a high percentage of the finished product. But it's a *small* percentage of the *value* of the product. So quality and uniformity are the prime considerations in wood flour.

The new Wilner wood flour mills were engineered to provide the highest precision and automation in processing control. The plants are so completely automatic, they could be operated by pushbutton from the president's office. Continuous moisture and rotap testing guarantees that the flour, once tailored to the mix or formulation, never varies. The user is assured of wood flour milled from kiln-dried, clear white pine, free from contamination, with a low moisture content, and in any mesh size desired.

Typical Analysis
140 Mesh Wood Flour

Thru	On	
	100	trace
120		99.2
140		96
170		86
200		75.6
270		49.2

Among the users of Wilner Wood Flour

ARMSTRONG CORK CO.
BIRD & SON
BONAFIDE MILLS, INC.
GENERAL ELECTRIC CO.
ROHM & HAAS CO.
STANDARD TANK & SEAT CO.

For samples, further information and specifications, please write:

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Wilner Wood Products Co., Norway, Me.

tions for wood. The group will become part of the central research laboratory in Philadelphia, and will be headed up by George Kitazawa, former Gillette research physicist.

Forest products development work, primarily in industrial adhesives, had formerly been carried out in the Bainbridge, N. Y., and the Seattle, Wash., laboratories. Borden's chemical division manufactures, among other products, a varied line of adhesives, coatings, impregnants, and binders for wood and paper. The firm introduced urea resin adhesives to this country in 1936.

To Expand Phenol Capacity

Plans for a major expansion in its phenol production have been announced by Monsanto Chemical Co., St. Louis, Mo. Several million dollars will be invested in additional production facilities at the Monsanto, Ill., plant, and capacity will be expanded by approximately 25%. Completion is scheduled for the latter half of 1958.

Enters Plastic Pipe Field

Simpson Logging Co.'s plastic pipe division, which had been owned and operated by M & M Woodworking Co., Portland, Ore., has been purchased by Portco Corp., Vancouver, Wash., and will be incorporated into that firm's paper and plastic division. Pipe production will be continued without interruption, and the division will be enlarged to meet increasing demands by established distributors.

Edward Baxter, who formerly headed up Simpson's plastic pipe division, has been named sales manager of Portco's plastic division. No changes, other than expansion, are anticipated.

Constructs Research Center

The resin research center of Resin Research Laboratories, Inc., and its affiliate company, Polymer Engineering & Development Corp., is currently under construction at 400 Adams St., Newark, N. J. When completed, it will consist of eight buildings, one of which will be equipped as a complete radiation laboratory. The other structures will house laboratories for research and development in resins and polymers, paint and coatings, adhesives, insulation, corrosion, rubber, and fabrication.

The center will have pilot plant equipment, including resin reactors of different types, plus attendant auxiliary equipment. The firms will then undertake pilot plant studies, process development, and, finally, design and construction of the full-scale commercial plant.

Borden Activates New Plant; Other Plans

The newly-completed PVC resin plant at Leominster, Mass., of the Borden Co.'s chemical division, New York, N. Y., was activated in December. Nearly 100% automated, the plant is Borden's first on PVC, and is geared to produce 12-million pounds of the resin per year.

According to H. W. Comfort, company president, Borden expects to triple the capacity of this plant before the end of this year. The plant consists of two buildings located on a six-acre tract adjoining the company's monomer department plant which produces polyvinyl acetate and polyvinyl alcohol. The new plant will produce a wide variety of specialty resins and latices, as well as general purpose PVC for the calendering and extrusion fields.

Borden plans to build a new laboratory-office building this spring. A one-story steel and concrete structure, the laboratory will consist of a development lab, a technical service lab, and a semi-pilot plant. Located adjacent to the new PVC plant, the laboratory will employ about 25 persons under the direction of Dr. Harry Wechsler, general manager of Borden's PVC department.

Borden also announced the acquisition of plant and office facilities at Leominster for production of its line of Resinite products, similar to that made by its Santa Barbara, Calif., operation. This new plant began production of vinyl compounds for wire and cable insulation and jacketing in January. The Resinite plant will begin production by March 1 of industrial tubing for the aircraft, electronics, and electrical appliance fields; extrusion of high-grade medical tubing; plastic garden hose; and flexible plastic lawn sprinklers.

Special Lab Group Organized

The research and engineering division of Monsanto Chemical Co., St. Louis, Mo., will establish a special laboratory to do research and development work on problems relating to national defense and national welfare which complement the company's own long-range projects. Herbert E. Morris, former associate director of research for Monsanto's plastics division, has been named director of the new group, which will be known as the special products department.

The new group will occupy the company's laboratory facilities at Everett, Mass. Research personnel of the inorganic chemicals division, who now use these facilities, will be transferred to a new lab at Creve Coeur, Mo., this summer. Active work of the new group will be initiated early this year, and full operation is expected by the end of 1958.

Forms Plastic Pipe Company

A new corporation, United Pipe & Tube Co., recently opened its plant in Lubbock, Tex. The firm will extrude plastic pipe for

use in oil, gas, and irrigation pipe lines, and eventually will coat steel pipe with plastic materials. Rigid PVC and styrene-acrylonitrile-butadiene compounds will be employed.

The management of United Pipe & Tube has wide experience in the plastics field. Walter S. Prendergast, president, has had 17 years service in plastics extrusions and coatings, most recently as vice president and general manager of an Eastern plastics concern. Rom Rhome, vice president, had been southwestern sales manager for a plastic pipe manufacturer. His duties will include both sales and financial management. W. F. Rippetoe, vice president, has had considerable experience in the sale and installation of plastic pipe. He will be in charge of United's subsidiary, High Plains Irrigation Supply Co.

United will produce pipe in six-, eight-, 10-, and 12-inch diameters. The large size will be used for casinghead gas-gathering systems, where it offers the advantage of freedom from internal corrosion by sour gas. The firm's initial battery of equipment includes four extruders.

Expansion Program in Progress

The $225,000 expansion program of Narmco Resins & Coatings Co., Costa Mesa, Calif., designed to greatly increase its output of aircraft structural adhesives and laminating materials, is scheduled for completion in March.

Approximately 7,000 square feet of factory space are being added to Narmco's productive facilities. The new installation will use explosion-proof electrical systems, special pumping and piping systems for resins and liquids, and a variety of atmospheric and quality control devices. Much of the specialized equipment was designed by the company's engineers.

The current building program is the first phase of a long-term growth plan that will see Narmco spending approximately one million dollars over the next three years, and more than tripling its total capacity.

Plan Vinyl Plant Expansion

A $4-million expansion for the Niagara Falls, N. Y., plant of Pathfinder Chemical Corp., subsidiary of Goodyear Tire & Rubber Co., Akron, O., has been announced by Russell DeYoung, Goodyear executive vice president.

The major portion of the expansion entails the construction of new buildings and equipment to provide for increased production of Pliovic vinyl resins. The program also provides for the modification of existing equipment to permit the production of new types of vinyl resins and latices by the Goodyear chemical division.

Construction work on the new buildings is presently under way, and the increase in vinyl output is expected after July.

Building New Acrylate Plant

The construction of a new acrylate ester plant in Pampa, Tex., is under way by Celanese Corp. of America, New York, N. Y. To have an annual capacity of 15-million pounds, the plant is expected to begin production during the last quarter of this year.

Acrylate acid esters are components for a broad range of end-products, including plastics, paints, adhesives, synthetic rubber, and finishes for paper, textiles, and leathers. Alcohols and other materials currently in large-volume production by Celanese will provide the raw materials for the Pampa plant.

In Brief . . .

Blisscraft of Hollywood formally opened its new, modern, million-dollar plant in Gardena, Calif., in December. Luxurious offices, a complete print shop, and a commissary for personnel are features of the new plant, which operates around the clock, six days per week, in producing the company's line of plastic housewares.

Resistoflex Corp., Belleville, N. J., has completed the new addition to its main plant in Roseland, N. J. The addition, started last February, doubles the production capacity and personnel of the firm.

Herbert R. Simonds, consulting engineer, has removed his offices from 551 Fifth Ave., New York City to Stepney, Conn.

Desert Minerals, Inc., Los Angeles, Calif., has appointed Smith Chemical & Color Co., Inc., Brooklyn, N. Y., as its exclusive agent in New England, New York, New Jersey, and Pennsylvania with the exception of Philadelphia. Desertalcs are used in paints and thermosetting plastics, and as dry lubricants.

G. Felsenthal & Sons, Inc., Chicago, Ill., has increased its injection molding production capacity by 10% as the first step in an over-all expansion program. The firm has just installed its 16th injection machine, and plans on adding four more within the next year.

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., has announced price reductions for quantity purchases of Teflon tetrafluoroethylene resin. The reductions range up to 40¢ per pound under the base price.

British Hydrocarbon Chemicals, Ltd., of Great Britain, a jointly-owned subsidiary of Distillers Co., Ltd., and British Petroleum Co., Ltd., has authorized the construction of a 25-million pound capacity polyethylene plant at Grangemouth, Scotland. The firm will manufacture the resin using Phillips Petroleum Co.'s new catalytic process.

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News from Abroad

Plastics in Iraq

Plastic materials are not produced in Iraq, and a report from the American Embassy there does not foresee manufacture in the near future. There are only three small factories making finished products using imported materials, and sales to these consumers are handled by direct contact with the supplier.

One factory in Baghdad has a transfer molding and two injection molding machines of American origin, and produces some 10,000 dozen beads, 30,000 combs, and 5,000 cigarette holders annually. Two other units, one in Baghdad and the other in Najaf, produce beads with hand-operated machines. Combined production at these two factories is estimated at 20,000 dozen beads per year.

Trade sources estimate plastic imports at 72 metric tons in 1954, primarily of the polystyrene type. The United Kingdom furnished 54%, and the United States supplied 26% of total imports. The remaining 20% was shipped primarily by Germany, Belgium, and Czechoslovakia. Until industry develops in Iraq, there is likely to be small demand for plastic materials.

Plastics in Burma

There is no production of plastic materials in Burma, and plastic products are manufactured from imported vinyls, polyethylene, and polystyrene. Thermosetting resins are not used; however, one company contemplates a phenolic molding operation.

Six manufacturers are engaged in the injection molding of combs, toothbrushes and cases, rulers, cups, saucers, plates, coat hangers, soap dishes, shoe horns, and other similar items. Consumption of materials by these processors is reported in the range of 400-15,000 pounds monthly. A large but undetermined number of home industries make polystyrene buttons with hand-operated machines, and about 20 small shops fabricate purses and belts from vinyl sheet.

Approximately 435,000 pounds of plastic materials were imported by Burma in 1955, and 1956 imports are estimated to be substantially greater. The plastics fabricating industry is growing, and duty concessions are granted to allow entrance of additional fabricating machinery. Plastic materials can be imported from sterling and other non-dollar sources without a license. United States material producers with affiliates in soft-currency countries are thus in a position to obtain some share of the future Burmese market.

Plastics in Yugoslavia, 1955

The only plastic material produced in Yugoslavia is PVC, which is manufactured by Yugovinyl, Kastel Sucurac, Croatia. Construction of this plant was commenced in 1947, and it has been in operation since 1950. Production reached 3,365 tons in 1955, and processed goods turned out by Yugovinyl include tubes, rods, sheets, and plates. The only materials imported for vinyl production in 1955 were some 500 tons of softeners.

Last year, the Yugoplastika plant began producing a wide range of consumer items such as clothing, footwear, luggage, toys, and packaging materials. The largest fabricator of consumer goods in Yugoslavia, it uses approximately 30% of the total domestic PVC production.

All enterprises are socialized, except for small handicraft workshops and sales shops. Foreign investment is forbidden by law, as are foreign branch factories. The government has a number of bilateral agreements covering the exchange of technical information with most of the Sino-Soviet Bloc countries and many Western European nations. United States exports are limited to such items that are unobtainable under bilateral trade and payments agreements.

Adhesive Bonding of Metals

A Conference on Metal Adhesion Technique, organized by the Metal Bonding section of the Chamber of Technology in East Germany, was held June 7-9, 1956, in East Berlin. A number of papers were read discussing the status of this method in East Germany and other satellite countries. Among the papers were: "On the Theory of Adhesive Bonding of Metallic Materials for Packings," P. Putz; "Epoxy Resins as Adhesives in Precision Mechanics and Optics," K. Maasz; "Processing and Application Possibilities of Epoxy Resins," W. Schaefer; "Adhesive Bonding of Metals in Machinery Construction," H. Kretzschmar; "Cementing Glass Panes in Plastic Composition Housings," W. Jahns; and "Use of Polyurethanes in Metal Adhesion," M. Muller.

Czechoslovakian and Polish delegates participated in the discussion that followed, mentioning experiences on the use of plastic adhesives for bonding metal in their respective countries. Representatives of the airplane industry referred to recent developments of the method for airplane construction.

At the close of the conference, several recommendations were made to the Metal Bonding Section urging more intensive research to develop suitable plastics for adhesive bonding. The Section also was asked to organize an international convention on the subject for the spring of 1958.

Various products for metal adhesive bonding are now available in East Germany; V.E.B. Chemische Werke Buna produces PVA-based material said to be useful where maximum strength is not needed, as well as Plastikator 32 (a butadiene polymerizate) for higher strength requirements. Since 1953, the Plastics Laboratory of the German Academy of Sciences in Berlin, in close collaboration with the V.E.B. Leuna Works, has been working on the production of epoxy bonding materials for metal. Buna Werke also is occupied with the same problem. The Leuna concern is reported to have assured its consumers in East Germany that hot and cold hardening epoxy adhesive resins will be produced by 1957. V.E.B. Farbenfabrik Wolfen has developed polyurethane adhesives; these are more important for bonding natural and synthetic rubbers to metals and other materials than for metal-to-metal adhesion.

Plastics in the Philippines

The feasibility of manufacturing polystyrene, polyethylene, and PVC has been investigated, but the market has not been large enough to support domestic production. Annual consumption of imported materials is estimated at three million pounds, with the United States accounting for 90% of the synthetic resins and over 60% of the sheeting materials. European and Japanese competition reportedly is increasing.

Over four times as much synthetic resins were imported in 1955 as in 1953, and the value of imported sheets and sheeting materials increased over 50%. Total output of the Philippine plastics industry, in terms of fabricated goods, was valued at $5-million in 1955. This also represents a fourfold increase.

A plant for the manufacture of urea-formaldehyde adhesives is currently under construction, and will have a capacity of about 10 tons daily. These adhesives will be used routinely in the domestic manufacture of plywood. Demand for plastic materials is expected to increase 10-30% annually for the next three or four years, especially for molding and extrusion compounds. Major obstacle is the dollar shortage and the consequent restrictions placed on processors in obtaining foreign plastic materials.

Plastics in Egypt, 1955

Plastic materials are not produced in Egypt, but some 15 firms are engaged in the manufacture of products from materials imported from Italy, United Kingdom, United States, and Germany. During 1955, a total of 1,008 tons were imported from all sources, an increase of 18% over 1954.

A breakdown by material imports in

1955 reveals the following figures: polystyrene, 40%; urea-formaldehyde, 17%; phenolics, 10%; polyethylene, 10%; PVC, 5%; vinyl sheets, 8%; acrylic sheets, 3%; and all other materials, 7%. A sizeable amount of celluloid rods, tubes, and sheets were imported.

Injection and compression molding are conducted by practically all firms, while extrusion operations are the specialty of medium to large firms. Coating is done by one firm, Egyptian Plastics & Electrical Industries, S.A.E., Alexandria, which produces plastic sheets for automobile and furniture upholstery. No firm is engaged in laminating work.

Egyptian exports are directed to the nearby Arab countries, especially Sudan and Saudi Arabia. In 1955, exports amounted to 51 tons valued at approximately $66,400.

Licenses French Firm

As the result of a recent licensing arrangement with the Campco division of Chicago Molded Products Corp., the Societe Plymouth Francaise, S. A., Feyzin, France, will manufacture Campco-type thermoplastic sheet. French representatives will be trained in the United States in both technical and merchandising methods, and the two firms will interchange ideas and machinery.

Swedish Plastics Convention

To commemorate its tenth anniversary, the Swedish Plastics Association organized a plastics convention and exhibition in Stockholm on Oct. 29-November 1, 1956. Several hundred persons attended the convention, at which a large number of papers on the manufacture, processing, and applications of plastics were presented by some 80 experts from various parts of Europe, as well as from America. Papers on unsaturated polyester resins for lacquers, and non-toxic stabilizers for PVC food packaging materials evolved great interest.

The exhibition, confined to products made in Sweden or imported by members of the Association, was designed primarily to instruct and interest the general public. This was assisted by a system of informative labeling of finished products, a procedure that seems to be rather new here.

Sweden's plastics industry has expanded considerably since 1939, when production of plastics material was only about 1,000 tons. In 1956, the total was put at 30,000 tons, and included nitrocellulose, phenolics, urea, melamine, polymethyl methacrylate, PVC, polyesters, and glass fiber. Although its population is only 7,000,000 and, on this basis, Sweden ranks with the smaller European countries, its per-capita consumption of plastics is said to be second only to the United States, and domestic production of plastic materials and products must be eked out by substantial imports.

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Names in the News

Donald E. Howell

Donald E. Howell has been named to fill the newly-created position of production manager for G. Felsenthal & Sons, Inc.'s fabricating division, Chicago, Ill. He previously served as plant manager for Tiletone Co., and for Claud S. Gordon Co.

Richard D. Dunlop has been promoted to the executive offices of the president, Monsanto Chemical Co., St. Louis, Mo. He has been serving as assistant general manager of the plastics division.

Walter S. Beanblossom has been named administrative assistant to management at Hooker Electrochemical Co., Niagara Falls, N. Y. He previously served as supervisor in the research and development department.

H. Joseph Sharkey has joined the organic research staff of Emery Industries, Inc., Cincinnati, O. Dr. Sharkey is a recent graduate of Oregon State College.

Harold J. Dawe has been appointed technical staff consultant of Acheson Industries, Inc., with offices in Port Huron, Mich. Former director of research for Acheson Colloids Co., Dr. Dawe will supervise the technical activities of all seven Acheson plants.

Ralph P. Lotz, former vice president and chief engineer of Plastic Products Corp., is now a consultant specializing in fiber glass molding and industrial design. He will maintain headquarters at 6621 Ridgebury Blvd., Cleveland, O.

Richard E. Dunning has been elected vice president in charge of manufacturing of Logo, Inc., Chicago, Ill. This includes the manufacturing and engineering sections, as well as warehouses. He previously served as plant manager.

William M. Cameron, former production supervisor for Keck Associates, has been appointed director of design for Planar Associates, Pasadena, Calif.

Harry A. Fedderson has been appointed technical director of Loven Chemical of California, manufacturer of phenolic molding powders and industrial resins. He was previously associated with Catalin Corp., and with Bakelite Co.

John K. May

John K. May, production superintendent of Pro-phy-lac-tic Brush Co., has been elevated to vice president in charge of manufacturing. In his new capacity, Mr. May will supervise all production, maintenance, and engineering for both the brush and the Prolon plastics divisions at Florence, Mass.

Joseph E. Mayl, vice president of Goodyear Tire & Rubber Co.'s general products group, has retired after 32 years of service. **Sam DuPree,** general manager of the industrial products division, succeeds Mr. Mayl, and will be responsible for coordinating group activities. **R. B. Warren,** former industrial products sales manager, has been appointed to the post vacated by Mr. DuPree.

Frank A. Connell has joined the marketing department of W. R. Grace & Co.'s polymer chemicals division. Former assistant plant manager for Koppers Co., Mr. Connell will serve as technical representative for the division's new linear polyolefins.

Bernard W. Lueck

Bernard W. Lueck has been elected vice president and a director of Zenith Plastics Co., Gardena, Calif., a wholly-owned subsidiary of Minnesota Mining & Mfg. Co. Mr. Lueck has been general sales manager of 3M's reinforced plastic products division, and will continue in that capacity in addition to his new duties as director of marketing and sales for the Gardena, Calif., firm.

H. W. Strong, Jr., has been appointed vice president in charge of operations at Colton Chemical Co., Cleveland, O., a division of Air Reduction Co. Following a six-year tenure with Harshaw, Mr. Strong served as new products manager and production manager with Colton.

Robert J. Schatz has been named associate director of research at the plastics division laboratory of Monsanto Chemical Co. in Texas City, Tex. He is succeeded as associate director of research in Springfield by R. I. Dunlap, assistant director of research.

Sanford Davis, Charles E. McClung, and **Seymour L. Axelrood** have joined the research and engineering division of Wyandotte Chemicals Corp. They will be concerned with polymer-applications research, and Mr. McClung will also serve in a counseling capacity on customer use.

John A. Yourtee has been appointed technical superintendent of American Viscose Corp.'s film division plant at Marcus Hook, Pa. He previously served as coordinator of research and development at the cellophane-producing unit in Fredericksburg, Va.

Vito A. Tanzi has been elected secretary of Speck Plastics, Inc., and **Walter R. Speck** has been elected secretary of Durable Formed Products, Inc. The two firms have a working agreement, and share molding facilities.

G. L. Pitzer has been appointed vice president in charge of production for Bakelite Co. He has served with Union Carbide since 1933, most recently as Bakelite's works manager.

Names in the News (Cont'd.)

Ferdinand C. Meyer has been appointed associate director of research in the central research department of Monsanto Chemical Co.'s research and engineering division, St. Louis, Mo. **Tracy M. Patrick, Jr.,** replaces Dr. Meyer as assistant director of research for the organic chemicals division.

R. P. Berry, Jr., has been named superintendent of Carbide & Carbon Chemicals Co.'s plant in Seadrift, Tex. Formerly the assistant superintendent, he succeeds **C. M. Blair** who has been assigned to the New York headquarters.

Theodore J. Collier

Theodore J. Collier has joined the staff of Brunswick-Balke-Collender Co., Chicago, Ill., as senior plastics engineer of the Marion, Va., plant. He formerly served as technical director of chemical control services for Owens-Corning Fiberglas Corp.

James H. Tompkins has been appointed director of research for Smooth-On Mfg. Co.'s plastics division. He will be concerned with the development and custom formulation of epoxy resin compounds and curing agents.

A. J. De Matteo

Adolphe J. De Matteo, a member of the Editorial Advisory Board of PLASTICS TECHNOLOGY, has been appointed general manager, of the Watson-Stillman Press Division, Farrel-Birmingham Co., Inc. He joined Watson-Stillman in 1944, and was named assistant chief engineer in 1946, and chief engineer in 1951. In his new capacity, Mr. De Matteo will direct the division's engineering and sales activities.

Marvin W. Formo, former research coordinator of Archer-Daniels-Midland Co., and **Alexander Olotka,** director of the Newark resin laboratory, have been advanced to assistant research directors. **Louis I. Hansen** has been promoted from research supervisor to senior research associate.

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H. F. Robertson

H. F. Robertson has been named manager of technical planning for Bakelite Co. In this newly-created position, Mr. Robertson will be concerned with future and long-range technological efforts of the research, product, and process development groups. **R. F. Clash, Jr.,** succeeds him as manager of the new products engineering department.

John A. Meima has been appointed to the newly-created post of technical service manager for the foundry department of Borden Co.'s chemical division. He had been technical service representative in the New Jersey-Pennsylvania area.

George O. Langlais has become a member of the technical service department of Monsanto Chemical Co.'s plastics division, Springfield, Mass. He previously served as technical director of the research foundation of Lowell Technological Institute. In other appointments, **E. S. Brockney** was named assistant sales manager for Polyflex 100 film and sheeting; **Howard B. Kreider, Jr.,** has become a member of the research department; **Charles S. Cheston, Jr.,** joined the sales staff; and James R. Hopkins joined the engineering department.

Frank P. Greenspan, former manager of organic research and development for Food Machinery & Chemical Corp.'s Becco Chemical division, has been named director of development for the new FMC organic chemicals division.

Victor J. Hauprich has joined Resin Industries, Santa Barbara, Calif., a subsidiary of Borden Co., as special assistant to the president. He previously served with Yardley Plastics as director of custom molding- and extrusion-customer relations.

L. W. Newton has been appointed assistant to the vice president—research of Carbide & Carbon Chemicals Co., New York, N. Y. Dr. Newton joined the company in 1941 as a member of the research department at South Charleston, W. Va.; became a group leader in 1951; and was named assistant superintendent of research in 1954. His work has been in the fields of organic acids, plasticizers and nitrogenous substances.

George Goldfinger has been appointed specialist in polymer chemistry at Armour Research Foundation, Illinois Institute of Technology, Chicago, Ill. Among other positions, Dr. Goldfinger served with Polytechnic Institute of Brooklyn and Godfrey L. Cabot, Inc.

G. Wayne Hanna has been named special sales representative, Dom-X pipe, for the plastics division of Dominion Gasket & Mfg. Co., Ltd., Toronto, Ont., Canada. Dom-X is the firm's designation for its new line of polyethylene and rigid PVC pipe and fittings.

H. B. Coons has been appointed plant superintendent at Carbide & Carbon Chemicals Co.'s facility in Niagara Falls, N. Y. He replaces **W. C. Heidenreich,** who becomes associate director of general industrial relations.

W. J. Ward was named leader of the special projects section of the research laboratory of General Mills, Inc., chemical engineering department, Minneapolis, Minn. He has been with the firm since 1947.

G. M. Hale was appointed vice president—sales for Canadian Resins & Chemicals, Ltd., Montreal, Que. He joined the company in 1946, and was general sales manager for the past year.

H. R. Spielman was named manager of the technical service department of Witco Chemical Co., New York, N. Y. He previously served as administrative assistant to the department manager, and joined the company in 1944.

S. Austin Marquis has been named manager of building products sales for L.O.F. Glass Fibers Co., Toledo, O. Formerly manager of the firm's automotive sales division, he will be in charge of the company's new home insulation, accoustical products, and thermal insulation for farms, metal buildings, and mobile homes. With the company since 1950, Mr. Marquis has served as production expediter, district manager, and automotive consultant.

Bakelite Co., New York, N. Y., has announced the appointment of three department managers in the sales organization, as follows:

J. L. Rodgers, as manager of the molding and extrusion materials department, which includes sales of molded housewares, toys, appliance components, phonograph recordings, automotive and industrial parts, plastic-insulated wire and cable, and extruded pipe and hose.

C. G. Youngquist, former manager of the company's Petrolia, Pa., plant, has been appointed chief engineer of the development department, Koppers Co., Inc., chemical division, Pittsburgh, Pa. He is succeeded at Petrolia by **Ronald Barraclough,** former assistant plant manager. In his new capacity, Mr. Youngquist will be responsible for the coordination of all phases in the engineering, design, and construction of major projects of the chemical division.

A. F. Sward, as manager of the bonding materials department, which includes sales of plastics for furniture laminates, plywood, reinforced plastics, grinding wheels, and foundry applications.

J. B. Knowles, as manager of the consumer products department, whose sales include vinyl film, sheeting, and resins for inflatable items, lamp shades and light fixtures, tapes, household and nursery items, wall coverings and flooring, and others.

Kenneth C. Loughlin

Kenneth C. Loughlin has been elected executive vice president of Celanese Corp. of America, New York, N. Y. He has been with the firm since 1929, most recently serving as vice president and general manager of the textile division. **John W. Brooks,** director of textile marketing, succeeds Mr. Loughlin with the title of vice president. Two other vice presidents have been appointed: **Ronald O. Gilbert,** who continues to serve as corporation secretary; and **Alexander R. Cochran,** who will coordinate planning of manufacturing facilities and engineering policies.

E. McKendree Hayden has been named special assistant to the president of The Stanley Chemical Co., East Berlin, Conn. Succeeding him as technical director of the company is **R. F. McTague,** former assistant technical director. In his new post, Mr. Hayden will be responsible for the development of new products, especially in the fields related to plastics. He directed the technical program of the company for the past 20 years. Mr. McTague has been with Stanley since 1940.

Bruce M. Bare has been appointed marketing manager, chemicals division, Atlas Powder Co., Wilmington, Del. He joins Atlas after serving with Dewey & Almy Chemical Co., and Sharples Chemicals, Inc.

Walter J. Geldard

Walter J. Geldard has been appointed marketing coordinator for Naugatuck Chemical division, United States Rubber Co., and will advise all of the division's commodity groups on sales policies and merchandising methods. He previously served as plastics sales manager for Naugatuck.

John V. Killheffer, Jr., has been appointed to the research staff of Emery Industries, Inc., and will be associated with the plasticizer group of the process research section. He previously served with Du Pont's organic chemicals department.

Frank J. Scully has been named commercial products sales manager for Zenith Plastics Co., Gardena, Calif., a subsidiary of Minnesota Mining & Mfg. Co. He has been with 3M since 1945, serving the past three years as sales supervisor of stationery trades and medical products for the retail trades tape division.

Dr. Clarence A. Stiegman has been named director of product development for Hooker Electrochemical Co., Niagara Falls, N. Y. In this capacity, he will direct the product development work of both the chemical and plastics elements of the company's business. A graduate of the University of Illinois, Dr. Stiegman joined Oldbury Electro-Chemical Co. in 1937. After serving in various capacities, he was vice president and technical director of Oldbury prior to its consolidation into Hooker last November.

James G. Couch

James G. Couch has been named manager of the production department's engineering section, U. S. Industrial Chemicals Co. He will be responsible for the design and construction of new plants, and the expansion and modification of existing units for U.S.I. and National Petro-Chemicals Corp.

Wesley C. Eckholm has been named to the newly-created post of general manager of manufacturing for the carbon black and pigment division of Columbian Carbon Co., New York, N. Y. He previously served as general manager of the company's carbon black production at Monroe, La. Mr. Eckholm is succeeded in this position by **M. R. Howell.**

R. K. Turner, a vice president of Bakelite Co., has been appointed a vice president of Carbide & Carbon Chemicals Co. He will be concerned with plastics operations for both companies, divisions of Union Carbide & Carbon Corp., New York, N. Y. Mr. Turner began his association with UCC in 1924, and has worked in research and plant management.

Morton M. Gruber has been named sales manager of surface coating resins for Reichhold Chemicals, Inc., White Plains, N. Y. Active in the resin field for over 25 years, Mr. Gruber most recently served as sales manager for Archer-Daniels-Midland.

Robert G. Reed

Robert G. Reed has been appointed business manager of Escambia Chemical Corp.'s research division. Prior to joining Escambia, Mr. Reed served as purchasing agent and property manager of National Research Corp.

Dr. B. D. Thomas has been appointed director of Battelle Memorial Institute, Columbus, O., succeeding **Dr. Clyde Williams.** Dr. Williams was promoted to president of the Institute. A member of Battelle's executive and technical staff since 1934, Dr. Thomas was named assistant director in 1942, secretary, and vice president in 1955.

Earl Erich has been appointed sales manager of Tube Turns Plastics, Inc., Louisville, Ky. A graduate of Muhlenberg College, he formerly was associated with Atlas Mineral Products Co. before joining Tube Turns in 1955.

Vincent L. Rebak has been elected president of the Salesmen's Association of the American Chemical Industry. Mr. Rebak is New York district sales manager for Grace Chemical Co., a division of W. R. Grace & Co. **Robert J. Roberts,** Emery Industries, Inc., was elected vice president. Other officers are **James E. Spencer,** Harshaw Chemical Co., secretary; and **George W. Poland, Jr., E. M. Sergeant,** Pulp & Chemical Co., treasurer.

W. L. Fawcett and **D. E. Setter** have been named sales service and development engineers of Phillips Chemical Co.'s plastics sales division, Bartlesville, Okla. **P. J. Boeke** has been appointed manager of the sales service laboratory branch. Assisting Mr. Boeke as group leaders will be **P. E. Campbell,** evaluation; **Robert Doyle,** extrusion; and **J. N. Scott,** molding.

Alan L. Lambuth has been appointed group leader for the research department of Monsanto Chemical Co.'s plastics department, Seattle, Wash. He has been a member of the research staff for almost 10 years.

Robert H. Pohl has been appointed director of sales for the pigments department of E. I. du Pont de Nemours & Co., Inc., succeeding **Frederic A. C. Wardenburg,** new director of advertising. **Edwin A. Gee** replaces Mr. Pohl as assistant director of sales, and is himself succeeded as sales manager for pigment colors by **M. James McLain.**

Gordon S. Swift has been appointed special representative, Prolon division, for Pro-phy-lac-tic Brush Co., Florence, Mass. He will handle sales and technical contacts in the custom molding field, working out of headquarters in Northampton, Mass.

Joseph A. McGroarty has been appointed to the newly-created post of industrial accounts manager for the sales department of Merck & Co.'s chemical division, Rahway, N. J. Among the accounts covered by the division are plastics, electronics, food and industrial chemicals, and meat packaging.

James A. Wold has been named general manager for the newly-created consumer products department of Borden Co.'s chemical division, New York, N. Y. Previously an administrative assistant for the firm's West Coast chemical operations, he will direct new product development and promote existing products.

J. W. L. Fordham, senior chemist at Diamond Alkali's exploratory research department in Painesville, O., has been appointed group leader in charge of monomers and polymer research.

John P. Holmes, vice president of Celanese Corp. of America, has been placed in charge of the company's foreign operations. In addition, he was appointed president of three subsidiaries: Celanese International Corp., Amcel Co., Inc., and Pan Amcel Co., Inc.; the latter two being trading corporations.

New Materials

Write item numbers on Readers' Service Card to obtain more information.

Release Agent for Epoxies

A release agent in gel form, which separates epoxy and other resin castings from plaster, gypsum cements, wood, metal, and other plastics, has been introduced by Smooth-On Mfg. Co. Called Sonite Seal-Release, the material is applied by rubbing, brushing, or spraying. Excess is removed with a soft cloth, and the material itself is rubbed to an imperceptible film.

Sonite Seal-Release seals surface pores, and can be thinned with naphtha or gasoline for deep penetration of porous molds. The material can be applied after soapsizing. The material is especially recommended for parting epoxy vacuum-forming molds from plaster or formed styrene sheets. Availability is by pint, quart, or gallon.

Readers' Service Item M-1

Three Resin-Based Adhesives

A series of resin-based, multi-purpose adhesives designated as Tygobonds have been introduced by the adhesives division of U. S. Stoneware Co. Intended primarily for bonding vinyl foams to themselves, vinyl fabrics, metal, wood, or composition bases, the adhesives are crystal clear and non-staining.

Tygobond adhesives require only contact pressure to produce water-, acid-, oil-, and alkali-resistant bonds. No cure is required, and the solvent used in the adhesives will not destroy the foam's cell structure.

Tygobonds 40 and 41 are formulated for spray, brush, or machine coating, and are recommended for joining vinyl or polyurethane foams to semi-rigid or rigid bases. Tygobond 45 is applied by brush, wiper blade, or machine, and is suggested for use in foam upholstery where the bond line must not telegraph through the overlay material. The adhesives also are suggested for bonding thermoplastic sheet and film, leather, paper, metal foil, felt, and other textiles.

Following are specifications reported for the adhesives.

	Tygo-bond 40	Tygo-bond 41	Tygo-bond 45
Color	Clear	Clear	Water white
Flammability	Flammable	Flammable	Flammable
Flash point, open cup, °F	40	40	40
Viscosity, cps.	70-150	3,200-3,500	500-1,000
Weight per gallon, lbs.	7.4-7.5	7.9-8	7.5-7.7
Coverage, sq.ft./gal.	200-250	200-250	150-200
Shelf life, mos.	8-12	8-12	6-8

Readers' Service Item M-2

Electrical-Grade Phenolic

Durez 18441, an ammonia-free phenolic molding compound, has been introduced by Durez Plastics Division, Hooker Electrochemical Co., for use where electrical-grade general-purpose material is required to minimize corrosion of electrical contacts and metal inserts. The compound is a single-stage, wood flour-filled phenolic with a very fast rate of cure. It has excellent insulation resistance, well above most general-purpose types.

Supplied as a granular material having a storage life of three months, and characterized by good finish of molded parts and low gravity, the new compound is suitable for compression and plunger or transfer molding methods. The molding compound has a bulk factor of 2.3, and is supplied in plasticity grades of 6, 8, 10, and 12. Properties of molded parts are as follows:

Specific gravity	2.3
Molding shrinkage, in./in.	0.005
Max. water absorption, %	1.0
Izod impact strength, min., ft. lbs./in.	0.29
Flexural strength, min., psi.	9,500
Tensile strength, min., psi.	7,500
Compressive strength, min., psi.	25,000
Distortion temp. at 264 psi. load, min., °F.	300
Hardness, Rockwell "M"	108
Dielectric strength, short-time, v/m	425
Volume resistivity, ohm cm.	1×10^{16}
Power factor at 60 cycles	0.05
Dielectric constant at 60 cycles	6.2

Readers' Service Item M-3

Stabilizer for Clear Vinyls

A uniquely-modified cadmium octoate, reportedly imparting good light and heat stability to clear vinyl products, has been placed on the market by Ferro Chemical Corp. Known as Ferro 203, the material is a light yellow organic liquid of low viscosity and practically no odor.

For general usage, 2.5 parts of stabilizer and five parts of an epoxy soybean-oil plasticizer are recommended for mixing with 100 parts of resin. Mineral oil is added for lubricity. Water absorption resistance is improved through the addition of 0.25 phr. stearic acid. Among the products where this stabilizer would be of decided advantage are convertible-auto window stock, garden hose, tubing, and film.

Readers' Service Item M-4

Polyester for Urethane Foams

A new polyester for the production of flexible urethane foams is available from Witco Chemical Co. under the name Witco Fomrez No. 50. The new product features a narrow hydroxyl number and viscosity range, as well as a uniformly low moisture content. According to evaluation tests by foam manufacturers, the new polyester produces reproducible foams having a minimum of deterioration and low compression set after exposure to accelerated humidity aging.

A typical analysis of Fomrez No. 50 is as follows:

Hydroxyl number	49-55
Acid number, max.	2.0
Viscosity, Brookfield, at 25° C., cps.	18,000-21,000
Color, Gardner, max.	3
Water content, max. %	0.1
Specific gravity	1.19
Appearance	Clear

A typical recipe for making two be: Witco Fomrez No. 50, 100.0 parts; pounds/cubic foot flexible foam would Witco 77-86 (coupler), 1.8 parts; n-ethyl morpholine 1.5 parts; water 3.3 parts; and tolylene diisocyanate (80% 2,4-isomer, 20% 2,6-isomer), 41.0 parts. In the Witco

pilot plant, a modified Blendometer was used for foaming. A masterbatch of the polyester, coupler, catalyst, and water is fed at 70-75° F. to the mixing head, while the tolylene diisocyanate was simultaneously forced in to the mixing head. Mixing speed was 2,700 rpm., and the material delivered at the rate of 4.4 pounds per minute. The reaction mixture was delivered into a polyethylene-lined mold, and foaming started in a matter of seconds. The foam was not removed from the mold until fully set. The finished foam had a compression set of approximately 4%, and less than 8% after humidity aging for seven days at 180° F.

Readers' Service Item M-5

New Polymeric Plasticizer

A new, high molecular-weight polymeric plasticizer, Emery 3049-S, has been developed by Emery Industries, Inc. A primary plasticizer for vinyl chloride polymers and copolymers, the material also is of interest for use with nitrocellulose, ethyl cellulose, cellulose acetate butyrate, and synthetic rubbers. Light colored in appearance, the new material is said to overcome processing difficulties often encountered with high molecular weight plasticizers, permitting easy processing on conventional equipment.

The viscosity and wetting characteristics of 3049-S make it an excellent plasticizer for dispersions and pigment grinding. The material also provides all the extreme-performance characteristics of high molecular-weight polymeric plasticizers, including very low migration, excellent resistance to extraction, low volatility, and excellent electrical properties. The plasticizer has a maximum acid number of 5; maximum hydroxyl number of 15; maximum Gardner color of 5; and a viscosity of 25° C. of 550-650 poises.

Comparative performance properties of 3049-S and DOP plasticizers in Geon 101 PVC are given below:

	Emery 3049-S	DOP
Volatility after 24 hrs. at 70° C., % loss in carbon	0.65	1.25
Migration (Goodall-Sanford) after 7 days at 25° C., % loss	0.30	1.90
Low-temp. flexing (Masland), °C. failed at	—10	—30
Tf (Clash-Berg), °C.	—4.5	—14.0
Heat stability, min. at 350° F.	60	60
Fadeometer failure, hrs.	300	300
Durometer "A" hardness	84	83
Lacquer lift, nitrocellulose	None	Slight
Tensile strength, psi.	2,500	2,800
Modulus, psi., at 100% elongation	1,240	1,270
Elongation, %	350	370

Suggested applications for the new plasticizer are in making infant accessories, upholstery materials; industrial tapes and gaskets, and other products needing permanence and low migration of plasticizers. Its synergistic effects with other plasticizers make it worthy of investigation for other applications.

Readers' Service Item M-6

Phthalate Ester Plasticizer

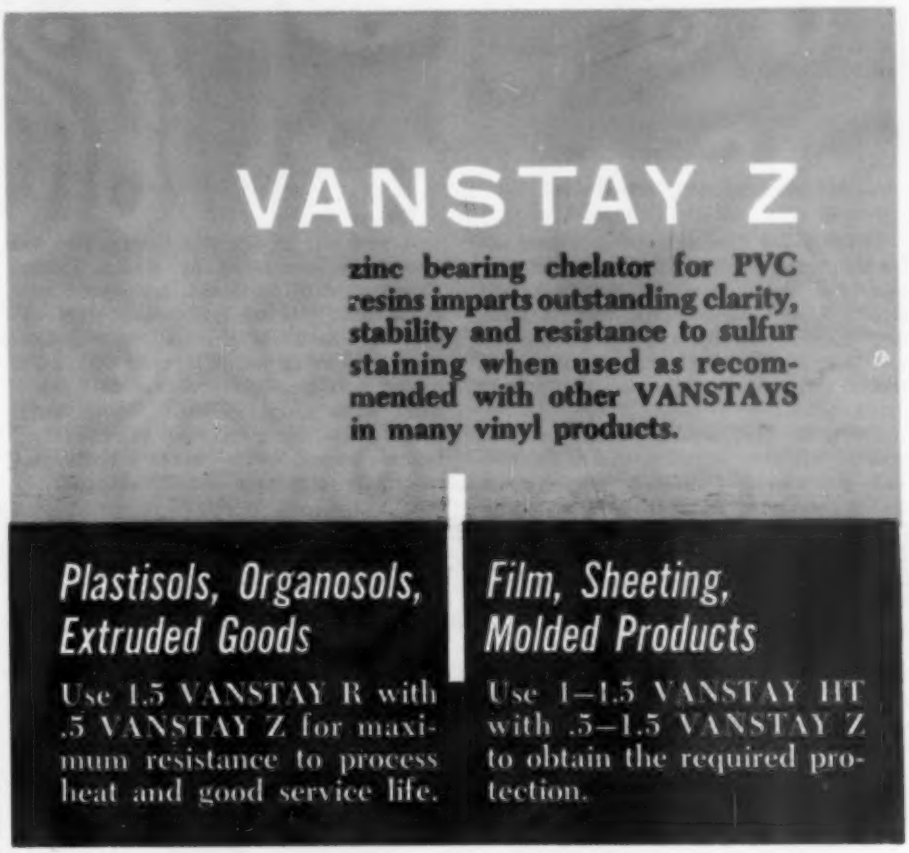
A low-cost phthalate ester plasticizer for extruded vinyls, coated fabrics, wire and cable coverings, and slush and dip moldings has been introduced by Brown-Allen Chemicals, Inc. Called Polycon 40, the material is intended to replace the more expensive DOP in formulations where color is only a minor factor.

Among Polycon 40's features are dry feel, non-rubbery consistency, superior solvation, improved extrusion rate, and easier processing at high-Durometer hardness. The plasticizer tolerates relatively high amounts of extenders and filler loads. In a standard test for wire and cable, the material showed 30% greater retention of elongation than a formulation containing DOP. Other features include a high initial viscosity, fast gel rate, and fast cure for special plastisol formulations.

Following is a list of properties reported for the material:

Specific gravity	1.05
Acid number	0.05
Color, Gardner	11
Viscosity, stks.	2.5
Weight, lbs./gal.	8.9
Ester content, %	99.5

Readers' Service Item M-7


VANSTAY Z
zinc bearing chelator for PVC resins imparts outstanding clarity, stability and resistance to sulfur staining when used as recommended with other VANSTAYS in many vinyl products.
Plastisols, Organosols, Extruded Goods
Use 1.5 VANSTAY R with .5 VANSTAY Z for maximum resistance to process heat and good service life.
Film, Sheeting, Molded Products
Use 1–1.5 VANSTAY HT with .5–1.5 VANSTAY Z to obtain the required protection.

When Roll plating is a problem:

Use 1.5 VANSTAY N with 1.5 VANSTAY Z as the stabilizing system.

Our Technical Service Representatives will gladly demonstrate the merits of our materials in your plant and assist in solving production problems.

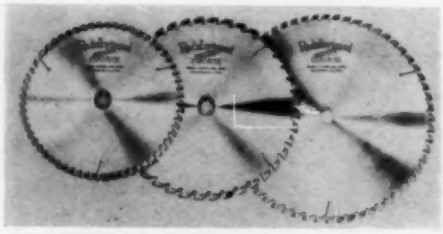
Oliver

R. T. Vanderbilt Co., INC.
230 PARK AVENUE, NEW YORK 17, N. Y.

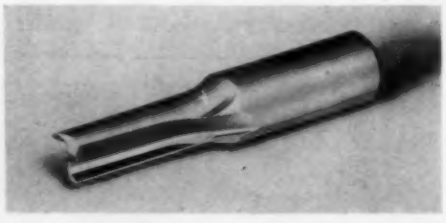
New Equipment

Write item numbers on Readers' Service Card to obtain more information.

Saw Blades and Router Bits



Radialloy-Tipped Saw Blades



Carbide Router Bit

Heat-treated, precision-ground, steel saw blades with permanently-brazed carbide tips have been placed on the market by Radial Cutter Mfg. Corp. Named Radialloy-Tipped Saw Blades, they feature full steel backing for maximum support plus a special safety lock to prevent the tip from flying off.

Extensive field testing in the fields of printed circuitry, acrylics, ureas, fabric—and paper-base phenolics, polystyrenes, PVC, butyrates, and high-pressure laminates has shown the blades to operate over 2,740 hours without sharpening. Straight-line cuts were made using rip machines which operated at speeds up to 300 feet per minute.

Smooth cuts are reportedly assured, and pieces are ready to be rejoined without refinishing. The saws are available in diameters from 6-18 inches and with 30-80 teeth.

A new line of Carbide Router Bits has also been introduced by Radial Cutter. Constructed of hardened, high-speed steel shanks, the bits are heat-treated to Rockwell "C" hardness of 55-60 to withstand shock and vibration. A tapered web in the router flute prevents breakage and eliminates weak spots. A high "hook" angle eliminates pushing, and results in smoother, faster cutting. Special brazing techniques reportedly eliminate the breaking-off of tips.

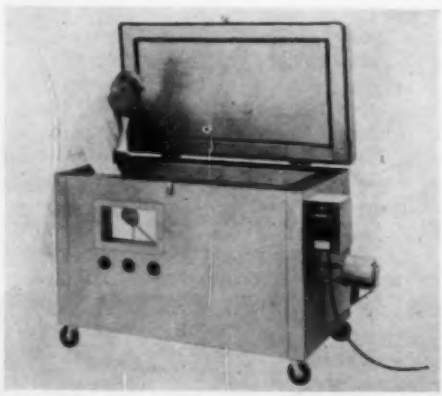
The bits offer razor-sharp edges with super-finished O.D. and radial relief grind. Seven different bits are available, with ¼- and ½-inch shank diameters. Diameter of the cutting edge ranges from ¼-½ inch. Cutting-edge lengths, shank lengths, and tool lengths are ¾-1¼, 1¼-1¾, and 2-3 inches, respectively. The bits are made with one or two flutes.

Readers' Service Item E-1

Environmental Test Chamber

A multi-environment test chamber, reportedly capable of maintaining temperature from −100 to +400° F. within ±2° F., has been introduced by Mantec, Inc. Constructed entirely of steel, the new Model D-102A has a 12-cubic foot, stainless steel inner chamber completely sealed to prevent moisture seepage.

Chamber temperatures can be dropped to −65° F. in 40 minutes, or raised to +400° F. in 30 minutes, using room temperature as the starting point. Low temperatures are obtained by placing dry ice in a special compartment. Refrigerated air is continuously circulated over the test parts in a double convection system. High temperatures, selected by a three-wattage switch, are supplied by an electric heating element. Operating with a minimum heat setting, the thermostat maintains temperature within two degrees of the control point.



Mantec's multi-environment test chamber.

The counter-sprung lid is hinged at the rear, allowing full access to the inner area. The lid locks in full-open or closed position. Standard design includes a triple-pane, sealed observation window, and three instrumentation ports. The latter are three inches in diameter.

Construction and material specifications include: six-inch glass wool insulation compressed to 5½ inches; working chamber dimensions, 32½ by 22 by 28 inches; dry ice chamber dimensions, 14 by 22 by 28 inches; and a 14 by eight-inch observation window. Outside dimensions are 60 by 33½ inches, and height is 42 inches. Power requirements are 115V-60 cycles AC (2,500 watts), or 220V-AC single phase-60 cycles (2,500 watts).

Readers' Service Item E-2

Plastic Sheet Folder-Creaser

A combination folder-creaser for cast and extruded thermoplastic sheets measuring 0.005-0.02 inch thick has been introduced by Taber Instrument Corp.'s sheet plastics equipment division. Designated the Thermatic Folder-Creaser Model 178, the unit forms right-angle creases for the fabrication of rectangular boxes and covers, and also forms 180° flat folds for making card holders and page protectors.

Taber's Model 178 folder-creaser unit.

A 3/64-inch folder blade is standard equipment; the 0.015-inch radius edge creasing blade for 0.01-0.02-inch material is available at extra cost. Blade lengths are 31 inches, which accommodate folds and creases up to 30 inches in length. For changing from folding to creasing, the creasing blade is substituted in the holder and the electric timer circuit is turned to "off" position which renders the movable front folding bar inoperative. The rear folding bar is removed, and the front table section is backed off to allow the sponge rubber pad and metal V-die to drop into place.

For the folding operation, compressed air at 60-100 psi. is used to actuate the movable front die section. This squeezes the fold to accurate thickness and chills the material to a permanent set. Production rate depends upon the size of the

blank and operator skill; however, the folding cycle should approximate two seconds and the creasing cycle should be about one second.

The machine is 41 inches wide, 24 inches deep, and 42½ inches high. The finish is gray hammertone enamel, and the work surface is gray Formica. Net weight is approximately 360 pounds.

Readers' Service Item E-3

Vertical Hydraulic Press

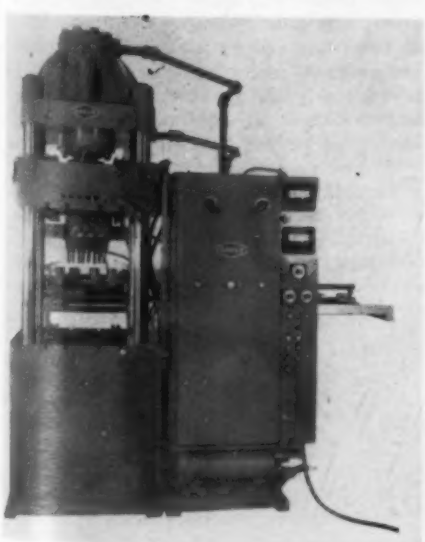
A 150-ton compression press capable of manual, semi-automatic, and automatic operation has been introduced by Baker Brothers, Inc. Designated Model 400-150, the press has a closure speed of 6.1-355 inches per minute, with automatic deceleration at any point in the pressing stroke. Complete flexibility of control over any kind of cycle can be maintained.

The hydraulic system is powered by an oilgear duplex axial-piston pump, and the reservoir is separate with thermostatically-controlled, water-cooling system. A drilled steel-block valve manifold eliminates all flexible lines, and all valving is gasket-mounted for ease of maintenance and minimum leakage.

Electrical controls provide for automatic feeding, ejection, flash cleanout, de-gassing, and deceleration. Discardable relays permit instant change without down-time. Mold temperature control instruments are available if desired.

Press stroke is 15 inches, and maximum distance between platens is 30 inches. The hydraulic cylinder has a working pressure of 3,300 psi., and pressure can be controlled at any point between 14 and 150 tons. Automatic feeding is accomplished with the Baker universal loading board and automatic metering device.

Model 400-150 meets all J.I.C. specifications, electrically and hydraulically. The press measures 78¼ by 74⅞ inches, and is 118½ inches high.

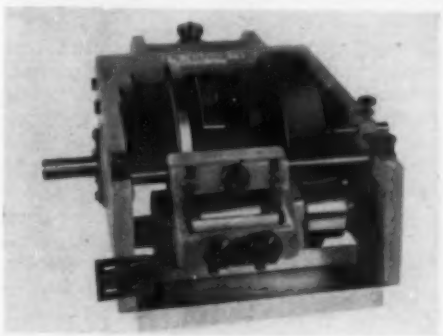


Baker Bros.' 150-ton automatic press.

Readers' Service Item E-4

Roll Printer for Extrusions

A roll printer for marking plastics and other materials in sheet, strip, or tube form has been placed on the market by Markem Machine Co. Designated Markem Model 15AE Roll Printer, the machine is mounted over a roll through which stock passes, or above a conveyor belt. A rubber-covered friction drive wheel rests on the stock to be printed.



Roll printer for plastic extrusions.

Stock must be at least five inches wide to actuate the drive wheel, if full 1¾-inch printing width is desired. For narrower strip stock, the unit can be powered by a ¼-hp. motor through V-belt sheave or chain-drive sprocket mounted on the machine shaft.

Sponge-backed rubber printing plates mounted on curved steel plates are held on the die wheel with spring tensions, thus permitting rapid change. Printing plates may be up to 24 inches long, for repetition of imprint every 24 inches. Operating speed is governed by the stock movement speed.

Machine dimensions are 18¾ by 12½ inches, and 7¾ inches high. Shipping weight is 60 pounds.

Readers' Service Item E-5

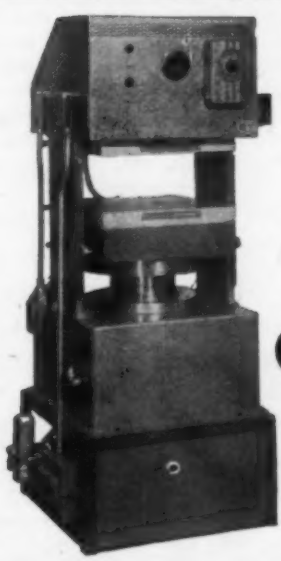
High-Speed Compression Press

The first in a series of automatic molding presses, Model 450-B, has been introduced by Hull-Standard Corp. Equipped with a flexible feeding mechanism, the unit can accommodate 1-2 cubic inches of molding powder per station. This particular press has 16 stations, and the output of several can be combined to fill larger cavities.

Smooth take-off of finished parts is provided by a motor-driven reversing carriage. A comb slides between knockout

HYDRAULIC PRESSES

20 tons to 500 tons ram pressure



Platen area 8 to 24 inches

Motorized hydraulic system

Controlled platen temperatures to 600° F

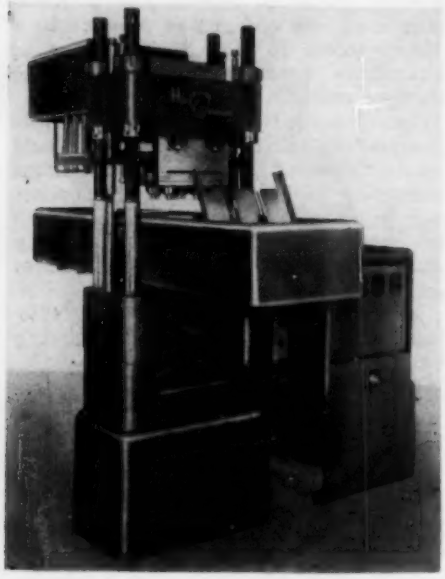
Automatic time cycler

Customized to your requirements

PHI PRESS *formerly Preco*

Write for circular or if you prefer we'll have our nearest representative call on you...

Pasadena Hydraulics, Inc., 1433 Lidcombe El Monte, California



Hull-Standard Model 450-B press.

pins and receives ejected, finished parts which it transfers into a receptacle. Automatic in operation, the machine may be operated as a semi-automatic press for testing and breaking-in molds, or for the production of small and sample lots.

The automatic cycle includes filling of mold cavities with accurately measured charges, closing, precision - controlled breathing, curing, opening, and ejection of finished parts. The swinging take-off provides easy access for mold installation, and the Quickset cycle control provides independent regulation of each press operation.

Specifications are reported as follows:

Maximum press capacity, tons	75
Dry cycle time, sec.	12
Closing speed, sec.	2.9
Opening speed, sec.	2.7
Floor space required, in.	72 x 79
Height, in.	89
Maximum distance between platens, in.	20.5
Bolster thickness, in.	4
Die space, in.	18 x 18.75
Platen stroke, in.	7
Ejector stroke, in.	2
Motor, hp.	3
Oil tank capacity, gal.	50
Pump pressure, psi.	850
T-slot spacing, in.	8
Hopper capacity, cu. ft.	1.75
Mold thickness allowable, in.	0.5-6

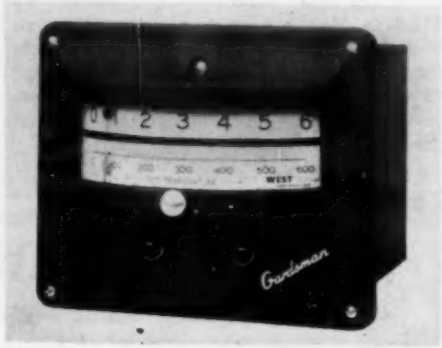
Readers' Service Item E-6

Four Temperature Controllers

A series of four three-position pyrometer temperature controllers has been introduced by West Instrument Corp. Designated as the JT series, the individual models are JT-2, JPT-2, JT-3, JPT-3. Model numbers followed by a "2" have one setting pointer and a 1% maximum spread between control points. Those followed by "3" have two setting pointers and a maximum spread of 20%.

Model JT-2 and JT-3 are equipped for on-off control of both lower and upper set points. Model JPT-2 and JPT-3 give proportioning control on the lower set point only, and on-off control on the upper set point. The latter are recommended where accurate temperature control is required with the added safety of automatic cooling. The instruments are said to eliminate costly manual control, reduce product spoilage, and prevent deterioration of equipment. They are used with plastic extruders, industrial ovens, and other equipment requiring multi-position control.

The controllers operate two instrument relays and have two control positions. When the indicating pointer is below both control positions, both instrument relays are actuated. When between control positions, the lower relay deactuates; above control positions, both relays are deactuated. For high-low-off control, valves or heaters can be controlled to produce a high heat on the initial temperature rise. When the lower control point is reached, the heat source will be switched to the low-fire condition; off, if the temperature rises to the upper control point.



West three-position temperature controller.

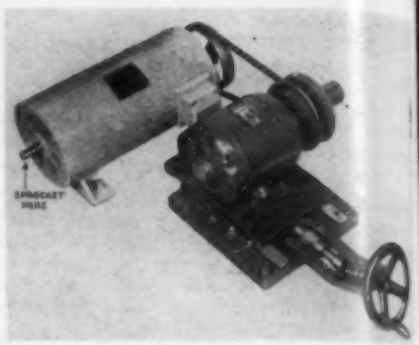
The instruments are wired for either 115 or 230 volts, and power consumption is 10 watts. The scale is indicated on a five-inch anti-parallax mirror. Thermocouple-break protection is standard with all models. Shipping container dimensions are 12 by 12 by 12 inches, and weight is 9½ pounds. net.

Readers' Service Item E-7

Winder for Film Extrusions

A winder, specifically developed for use with take-ups behind film extruders, has been introduced by Hobbs Mfg. Co. Designated the Hobbs-Alquist Type WS Winder, the unit is said to eliminate distortion of delicate extrusions by exert ing only low and constant tensions at low speeds.

Speed range of the winder is 1-1,200 rpm., and operating speed is automatically adjusted downward as the roll builds up and the torque increases. The speed is manually adjustable for changing widths of materials. The unit is basically an



Driving mechanism of Hobbs' film winder.

electrical differential. The assembly consists of a WS winder, ½-hp. motor, and a variable-speed unit to give the required range of adjustment of stator speed. The rotating stator is driven through the variable speed unit in the opposite direction from that required to wind. With the stator held stationary, the output shaft should turn in the direction of winding. Direction of rotation is reversed by changing the position of any two of the three leads to the unit.

Variable-speed pulleys are supplied to specifications. Tension is adjusted by altering the stator speed; increasing for lighter tensions, and slowing down for increased tension. A further tension range can be obtained through the use of a rheostat.

Readers' Service Item E-8

Glassed Spray-Rinse Value

A three-inch, glass line, spray-rinse valve, which reportedly eliminates manual cleaning of glassed steel reactors, has been introduced by Pfaudler Co. Designed to minimize the build-up of PVC on the inner surfaces of these reactors during the polymerization process, it permits a thorough wash-down without opening the manhole. This eliminates the steps of evacuating the vessel, purging with nitrogen, reevacuation, and purging to remove oxygen.

Installation is made through a conventional three-inch nozzle opening, and sufficient liquid is forced through the valve to wash any reactor up to 120 inches in diameter. A major portion of the liquid stream is directed upward toward the dome, with a smaller portion aimed 30° downward toward agitator and baffle. The spray-pattern spreader is adjustable through 360° by rotating the stem wheel with the valve open. Water or solvent can be used as the rinsing fluid.

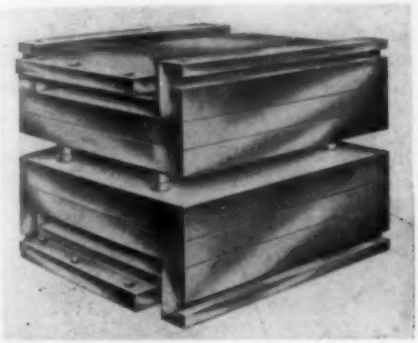
The valve is rated for 150 psi., but

Pfaudler glass-lined spray-rinse valve.

can be adapted for 300 psi. service with modifications of the valve body. When installing, the spray tip should project through the nozzle opening and into the reactor for 1-3 inches at the center line. Due to variations in nozzle heights, the valve is supplied with either seven-, nine-, eleven-, or thirteen-inch spray tip projections. The present model is designed for a three-inch I.P.S. tank nozzle with a two-inch I.P.S. liquid inlet flange. It is readily adapted to four-, five-, and six-inch I.P.S. tank nozzles by means of standard reducing flanges.

The lapped seat of the valve has a metal-to-metal contact with type 316 stainless steel. The inside parts are either glass-lined, or constructed of type 316 stainless steel. Ground-glass or ceramic seats are supplied on a custom-built basis.

Readers' Service Item E-6



Compression Mold Bases

Two compression-mold base assemblies have been placed on the market by Detroit Mold Engineering Co. Designated Standards 611-C and 1315-C, the bases are specifically designed for the Stokes Model 800-15 ton and Model 741-50 ton presses, respectively.

D-M-E Standard 611-C has cavity plates measuring six by 10⅞ inches, which feature built-in clamp slots conforming to the clamping locations on the machine platen. Air gaps insulate the cavity plates from the platens, and both the upper and lower ejector bar assemblies have clearance holes which contact the knock-out bars. Molded stop-pins assure trouble-free mold performance.

D-M-E Standard 1315-C measures 13 by 15 inches, and incorporates standard tubular dowels as well as the features claimed for the smaller 611-C. The dowels give maximum strength and alignment to the assembly, with a minimum of interference to the placement of cavities and heater lines.

D-M-E Standard compression mold base.

Readers' Service Item E-7

How Does Your
12 oz. Compare?
Check these SPECS for the H-P-M "12"
—The Hottest Machine on the Market
Daylight - - - - - - - - - - 30"
Stroke - - - - - - - - - - - 20"
Platen Size - - - - - - - 30"x33"
Max. Mold Space - - - - - 20"x30"
Plasticizing Capacity - - - 135 lbs.
general purpose polystyrene
Injection Speed - - 1150 cu. in./min.
Electric Motor - - - - - - - 40 hp

There's no equal for output. The H-P-M 12 oz. is built for full capacity punishment . . . and then some. There's no letup in demand from the big plastic market. Rely on H-P-M plastic molding equipment for consistent quality, consistent production. Get the full H-P-M story—today.

HPM

THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.
A DIVISION OF KOEHRING COMPANY

New Products

Write item numbers on Readers' Service Card to obtain more information.

Bolta-Top counter and backsplash.

Flexible Plastic Laminate

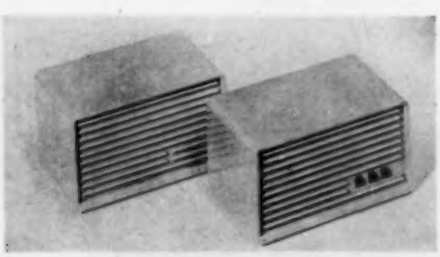
A virtually-stainproof surface is afforded by Bolta-Top, a flexible plastic laminate for counter tops, backsplash areas, and similar applications. A development of General Tire & Rubber Co.'s Bolta Products division, Bolta-Top is made by bonding vinyl sheet to a fiber backing and covering the surface with transparent polyester film.

According to recent laboratory tests, Bolta-Top has an abrasion resistance equal to high-pressure laminates. It also is impervious to most staining agents. Availability is by the yard, in widths of 27 and 46 inches. Red, gray, and green colors are to be had in a pearl pattern; and a linen pattern is marketed in charcoal, gray, red, yellow, green, and buff.

Readers' Service Item P-1

Urea-Housed Intercom Set

A portable Intercom Set designed for home or office use, and featuring a Plaskon urea cabinet, has been placed on the market by Telectronic Laboratories, Inc. No special installations are required: simply plug into any standard 110-volt A.C. wall outlet.



Urea-housed, two-way Intercom Set.

The two-way electronic device consists of two basic units: a remote station which serves as a pickup unit; and a master station which functions as the control unit. Fifty feet of insulated wire connect the two units. Controls are located on the face of the master station, and consist of three switches: "On-off," "Volume Control," and "Press-to-talk." The set uses three radio tubes for sensitive reception.

The sets are available in six different colors: ivory, pink, blue, green, yellow, and walnut. Plaskon urea is supplied by the Barrett division of Allied Chemical & Dye Corp.

Readers' Service Item P-2

Vinyl Foam Chair Cushioning

Vinyl foam, based on B. F. Goodrich Chemical Co.'s Geon 121 paste resin, is being manufactured by Brown Rubber Co.

School desk-seat features vinyl foam upholstery.

Featuring an embossed surface integral with the foam itself, the material is being used by the American Seating Co. for upholstering school-desk seats.

The vinyl foam withstands moisture, mildew, and the rough treatment given it by children. Special coverings are not needed, and a number of colors are available.

Readers' Service Item P-3

Scotchpak B polyester film heat-seals to tubular form.

Heat-Sealable Polyester Film

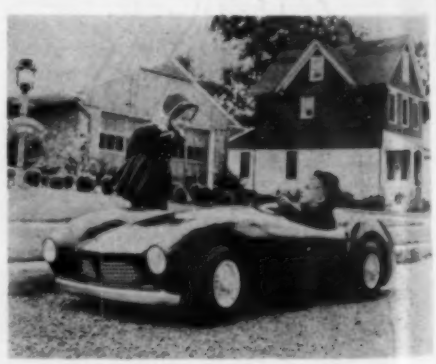
Clear polyester film, heat-sealable on both sides, has been introduced by Minnesota Mining & Mfg. Co. Called Scotchpak B, the film can be combined into tubular forms. Tensile strengths up to 8,700 psi. have been reported for the 1½-mil gage, plus a 270% elongation at break. The film is supplied in standard roll lengths of 700 and 1,000 yards, and in widths up to 19½ inches.

Readers' Service Item P-4

Child's Plastic Sports Car

Ultimate in toys for children is the sports car manufactured and distributed by Amroc Engineering. Molded in one piece from fibrous glass-reinforced Marco resin, a polyester produced by Celanese Corp. of America, the car is a true-proportioned, running model.

Powered by a gasoline engine, the car incorporates an automatic transmission which may be adjusted to speeds of 5-30 mph. Battery-operated lights, pneumatic tires, and vinyl-covered foam rubber seats add to its realism. The rear engine is

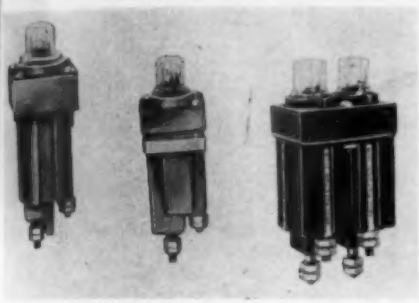


One-Piece reinforced plastic child's car.

easily accessible through a hinged rear compartment. Dual exhausts, a floor-mounted gear shift lever, and a dash-mounted ignition switch are included.

The car measures approximately 80 inches in length, and can accommodate two children or one adult. Authentic automotive paints are used, and color may be specified.

Readers' Service Item P-5



Plaskon alkyd fuse-carriers.

Alkyd Fuse Holders

Heavy-duty fuse holders, designed to indicate a blown fuse by means of a flashing light signal, are being molded from Barrett's Plaskon alkyd resin by Engineered Plastics, Inc. Fuse Indicator Corp. markets the product.

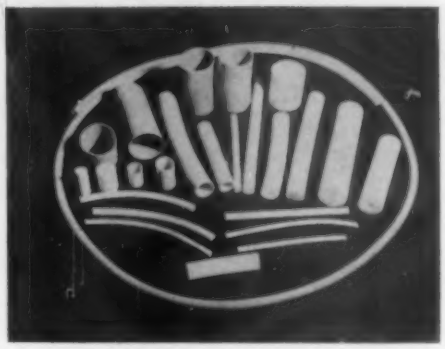
The fuse holders consist of a glass fiber-reinforced alkyd mounting base which attaches to the rear of the panel or switchboard, and one or more alkyd fuse carriers with built-in indicator lamps. The carrier component is removable from the front by a push-twist action. The over-all assembly is particularly useful for instrument, power, and telephone panels where rapid replacement of fuses is of prime importance.

Readers' Service Item P-6

Fluorocarbon Pipe and Tubing

Pipe and tubing fabricated from Du Pont's Teflon tetrafluoroethylene resin, and steel pipe lined with Teflon are presently available from Haveg Industries, Inc. Sizes up to four inches in diameter are fabricated from Teflon alone, while the lined pipe is stocked in two-inch size.

Intended primarily for steam and high-temperature corrosive chemicals, the piping is relatively flexible over a wide temperature range. It is resistant to abrasion and thermal shock, and will withstand pressures up to 150 psi. The lined piping furnishes even greater resistance to shock and vibration.



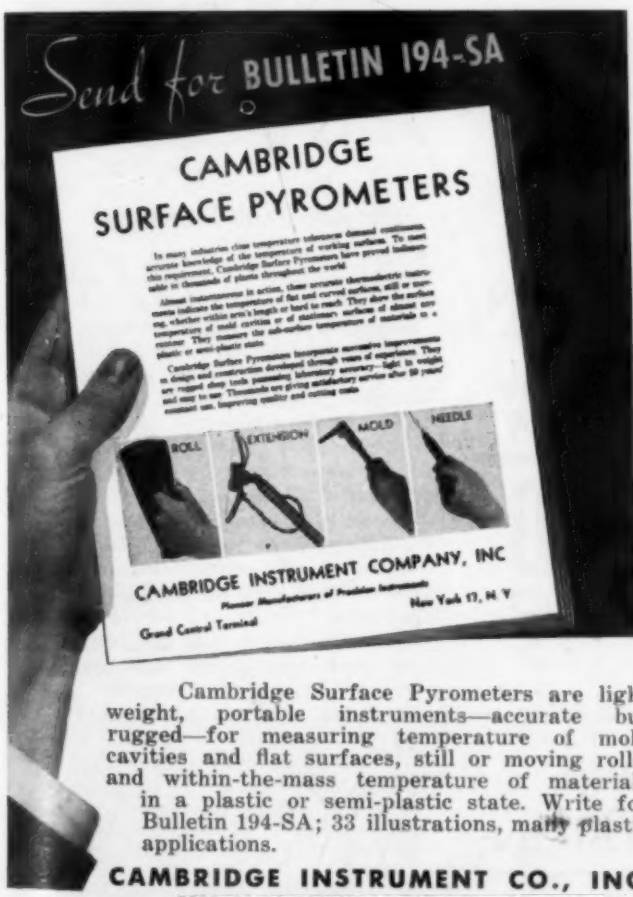
Teflon pipe, tubing, and rods.

Dielectric properties are reportedly excellent, regardless of temperature. Teflon's low friction characteristics make it ideal for conducting sticky materials. ASTM tests show it to have sub-zero moisture absorption.

Readers' Service Item P-7

Vacuum-Formed Plastic Signs

Three-dimensional, vacuum-formed, self-sticking signs for window and in-store displays have been introduced by Goodren Products Corp. Called Goodstix 3-D Displays, the signs are available in convex



Cambridge Surface Pyrometers are light weight, portable instruments—accurate but rugged—for measuring temperature of mold cavities and flat surfaces, still or moving rolls, and within-the-mass temperature of materials in a plastic or semi-plastic state. Write for Bulletin 194-SA; 33 illustrations, many plastic applications.

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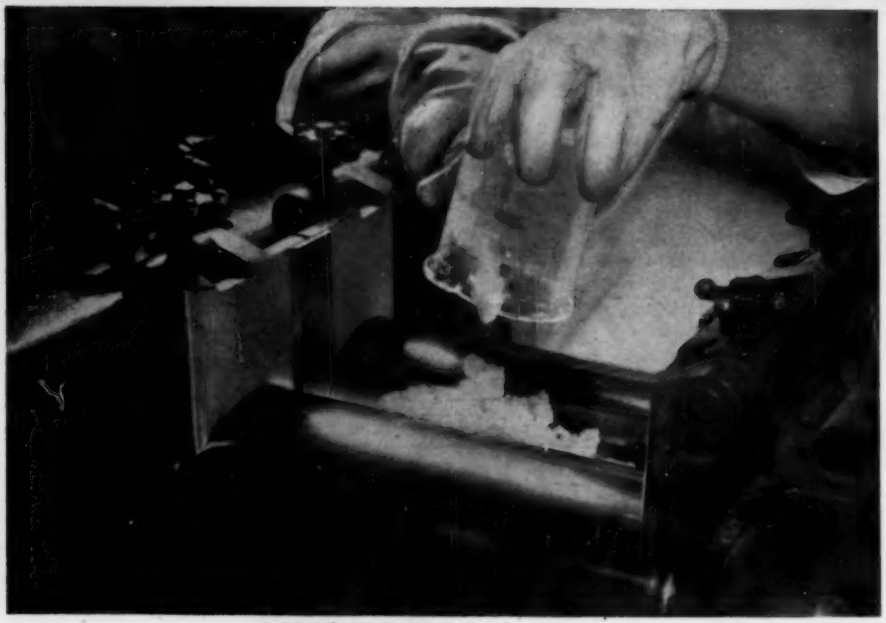

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IN 50 SECONDS WITH...

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H-22

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IN CANADA: W. C. HARDESTY CO. OF CANADA, LTD., TORONTO

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is a pure dibasic acid

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Four vacuum-formed signs printed on transparent acetate.

form for outside the store window, or as concave shadow-boxes for inside the glass.

In the design (pre-printing) stage, allowance must be made for the finished height of the piece after vacuum forming. Printing is done out-of-register, so that the finished sign will assume its proper proportions. Each display carries its own adhesive to facilitate quick posting.

Readers' Service Item P-8

Fire Resistant Laminate

A fire-resistant, paper-base laminate called Phenolite Y-2500 has been introduced by National Vulcanized Fibre Co. Bonded with a modified phenolic resin, it provides arc resistance up to 100 seconds. The material passes the standard Underwriters' Laboratory flame test for self-extinguishing laminates.

Phenolite Y-2500 is said to punch and shave better than the melamine-paper base laminates currently being used. Flexural strength properties, depending on thickness, average 16,900-19,500 ps^i. Density of a $\frac{1}{16}$-inch sample is 1.43, and impact strength for a $\frac{1}{8}$-inch chip is 0.41-0.49 foot-pounds per inch.

The laminate is currently being used in the production of arc deflectors, circuit breaker components, electrical switches, and other interrupting devices. Phenolite Y-2500 is available in standard semi-gloss or dull finishes, either natural (light brown) or red. Sheet sizes are 39 by 47 and 39 by 39 inches. Thicknesses vary from 0.015-1 inch.

Readers' Service Item P-9

New Literature

Write item numbers on Readers' Service Card to obtain copies.

"Marvinol VR-12." Bulletin No. 3. Naugatuck Chemical, division of U. S. Rubber Co. 12 pages. Physical properties, premixing cycles, fluxing and banding rates, extrusion rates, and formulations are listed for this general purpose PVC resin. Application photos are included.

Readers' Service Item L-1

"Farrel-Birmingham 6″ x 13″ Laboratory Mills for Rubber and Plastics." Bulletin 203. Farrel-Birmingham Co., Inc. 12 pages. General and electrical specifications are listed for each of the firm's six standard models. Photos and accessory-parts information are included.

Readers' Service Item L-2

"Spray or Pour Nafil Components for Polyurethane Foam." Chase Chemical Corp. 6 pages. Technical data and suggested applications are given for Nafil resin and catalyst components to make polyurethane foams ranging in density from 2-20 pounds per cubic foot.

Readers' Service Item L-3

"Modern Lighting with Perspex Acrylic Sheet." R.A.I.C. File No. 24. Canadian Industries, Ltd. 8 pages. This illustrated bulletin describes the forms and properties of the material, and gives information on its use in diffused indoor lighting, planned daylighting, and both indoor and outdoor luminaires.

Readers' Service Item L-4

Fiberglas is Working on the Railroad." Owens-Corning Fiberglas Corp. 54 pages. Illustrations and information are given on the uses of Fiberglas in the railroading industry. Applications include thermal, accoustical, and electrical insulations; fireproof fabrics; coated fabrics; and reinforcements for plastics. Uses range from construction and maintenance of rolling stock, buildings, fixtures, and furnishings.

Readers' Service Item L-5

"Proved by Performance." Bakelite Co. 8 pages. Performance of the company's polyethylene plastic in pipes for mine drainage systems, jet well installations, farm stock watering and irrigation systems, park sprinkler and home water systems is described and illustrated. Specifications for safe working pressures of standard wall pipe also are outlined.

Readers' Service Item L-6

"How to Identify the Code on Kralastic Bags." Naugatuck Chemical Div., United States Rubber Co. 4 pages. The code number on shipping bags refers to type, process method, color, color shade, and lubrication of the Kralastic contained therein. Detailed information is given on the coding system used.

Readers' Service Item L-7

"Why Plastic Tooling?" Bakelite Co. 10 pages. The flyer explains how production costs can be cut and model change-overs simplified through the use of Bakelite epoxy resins as tooling compounds. Thirty-nine applications are listed.

Readers' Service Item L-8

"Eastman Polymeric Plasticizer NP-10." Eastman Chemical Products, Inc. 8 pages. Properties, compatibility, stability, performance, and permanence of this polymeric plasticizer for PVC are reported in this bulletin.

Readers' Service Item L-9

"Cosmos Automatic Heat Sealer." Cosmos Electronic Machine Corp. 4 pages. This illustrated bulletin lists specifications for the unit, which not only performs all standard operations, but makes three-dimensional appliques in several colors and with different colored edges. Appliques are made by laying different colored sheets on top of the base material, heat sealing, and tearing off the overflow. The edges are produced through the overlay of four-gage material, heat-sealing, and the tearing-off of overflow on the inside.

Readers' Service Item L-10

"The Marblette Digest of Plastic Tooling." Marblette Corp. 8 pages. This digest summarizes existing applications for plastic tooling in metal- and plastic-forming, as well as foundry practice. Data and prices are included for the firm's phenolic and Maraset epoxy resins, with emphasis on casting, laminating, trowelling, splinging, and foam compounds.

Readers' Service Item L-11

"Kesscoflex Plasticizers." Kessler Chemical Co., Inc. 48 pages. Properties and specifications of 15 plasticizers are listed, including methoxyethyl, butoxyethyl, butyl and octyl esters, phthalates, adipates, stearates, oleates, and laurates. Performance data with PVC is presented, together with recommendations for its use with cellulose resins, polystyrene, and synthetic rubber.

Readers' Service Item L-12

"Lecton Acrylic Resin Coated Fabrics and Laminates." New Products Bulletin No. 5. E. I. du Pont de Nemours & Co., Inc. 6 pages. This bulletin describes and lists physical properties for Lecton, a family of acrylic-coated fabric constructions designed for electrical insulation uses. Swatch samples are included.

Readers' Service Item L-13

"Adhesives for Mylar Polyester Film." Bulletin No. 17. E. I. du Pont de Nemours & Co., Inc. 8 pages. This bulletin describes the modified synthetic rubber- and vinyl-type adhesives used for Mylar, plus a new class of polyester adhesives developed by Du Pont. Tabular property-data are given, together with information on laminations, applications, bonding, and safety precautions.

Readers' Service Item L-14

"Extrusion of Tenite Acetate and Tenite Butyrate." Eastman Chemical Products, Inc. 28 pages. Methods of forming these materials into sheets, variegated-color strips, pipe, and tubing by continuous extrusion are described in detail. Drawings, diagrams, and design principles are included.

Readers' Service Item L-15

"A Report on 1956." Injection Molders Supply Co. 6 pages. This report describes the advances made by IMS in 1956, the firm's seventh year in business. All new items brought out in 1956 are explained in brief.

Readers' Service Item L-16

"The Epoxy Resin and Glass Cloth 'Lay-Up' Repair to Iron and Steel." Technical Bulletin No. 14. Smooth-On Mfg. Co. 2 pages. The basic ingredients of the system are explained, and the procedures to be followed are enumerated and discussed in some detail.

Readers' Service Item L-17

"Marvinol VR-10." Bulletin No. 4. United States Rubber Co., Naugatuck Chemical division. 16 pages. Physical properties and applications are listed for this PVC resin, which is intended for plastisol formulations. Data is also offered on Celogen-AZ, a foaming agent for the compound. Application photos are included.

Readers' Service Item L-18

Book Reviews

"Vacuum Deposition of Thin Films." L. Holland. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Cloth, 6 by 9 inches, 584 pages. Price $10.00.

This comprehensive work deals with both deposition procedures and the physical properties of thin films. Vacuum-evaporation apparatus is discussed, together with basic plant layouts, the effects of backstreaming oil vapor on the quality of deposited film, high-tension supplies, and electrode arrangements for ionic-bombardment cleaning.

Since there is a high degree of degassing from plastics at reduced pressures, there often is difficulty in obtaining a vacuum pressure sufficiently low for depositing contaminant-free films. Problems encountered here are explained in detail, and suggestions are offered for overcoming them.

Considerable emphasis is placed on the use of heater materials other than the customary tungsten spirals, and the vapor intensity distribution of the different sources is described. Problems of metal alloy evaporation also are covered. Two new applications of the cathodic sputtering technique—metal oxide deposition, and the cathodic etching of metallurgical specimens—are explained in detail, since they are expected to bring about a revival of the sputtering process.

Other chapters are devoted to the durability of vacuum-deposited layers, the preparation of thin films for electrical purposes, optical interference films, evaporated aluminum films, and shadow casting. Numerous schematic drawings, charts, and graphs are included, and 25 photographs follow the subject index.

"Polyethylene." R. A. V. Raff and J. B. Allison. Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y. Cloth, 6 by 9¼ inches, 562 pages. Price, $16.00.

Volume XI in a series of monographs on high polymers, this work summarizes the state of knowledge about polyethylene up to mid-1956. Chapters are devoted to its historical development, the properties and manufacture of ethylene, methods of polymerizing ethylene, modified polyethylenes, the molecular structure of polyethylenes, properties of polyethylenes, analysis and testing of polyethylenes, processing and handling, applications, and a statistical summary. Numerous tables and graphs are included, together with tabulated references, author index, and subject index.

Among the specific points covered under polymerization are the effect of hydrogen, reaction medium, emulsion polymerization, catalysts, inhibitors, irradiation, and stabilizers. The section devoted to modified polyethylenes covers chain-end modifiers, chain grafting, copolymerization, chlorination, cross-linking, high-intensity radiation, and blending. Processing includes pulverization and working, compounding and coloring, molding methods, foaming, emulsification, coating, flame spraying, surface treatment, and printing.

"Correlation of Natural Weathering and Sheltered Storage Exposure Tests with Simulated Environmental Laboratory Tests." W. E. Laesch and W. W. Smith, South Florida Test Service for Wright Air Development Center. Order PB 121321 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 60 pages. Price, $1.50.

The purpose of this investigation was to find a possible correlation between natural and laboratory-simulated weather and storage tests for degradation of metals and plastics. Twenty-seven panels of cold-rolled steel, aluminum 24S, bolted aluminum 52S, and 14 plastic specimens of terminal boards, lucite, and laminated phenolics were used; taking measurements of weight, physical changes, and electrical resistance. Results showed no significant correlation between the simulated environmental results and data obtained from natural weathering tests on the metals, lucite, and laminated phenolics. A definite correlation was demonstrated, however, between results obtained on laminated phenolics and terminal boards exposed in sheltered storage and terminal boards exposed to direct weathering.

"Encyclopedia of American Associations." First Edition. Gale Research Co., 424 Book Tower, Detroit, Mich. Cloth, 8½ by 11¼ inches, 306 pages. Price, $15.00.

More than 7,000 organizations are listed in this reference work, which is divided into seven sections covering the following categories: trade, business, agricultural, and governmental associations; scientific and engineering associations; educational and social welfare associations; health and medical associations; general associations; chambers of commerce; and a finding guide index.

Arrangement is alphabetical by key word, and includes headquarters address, name of executive secretary or principal officer, number of staff members, year founded, number of local groups, and a general description outlining membership and purpose of the organizations. The cross index has more than 20,000 listings, enabling the reader to locate the proper organization from several different clues.

In addition to the basic volume, two supplements will be issued covering subject and functional groupings, as well as a semi-annual supplement of new organizations, changes of address, and deletions.

"Handbook of Chemistry." Ninth Edition. Norbert A. Lange, assisted by Gordon M. Forker. Handbook Publishers, Inc., Sandusky, O. Fabricoid, 5½ by 8 inches, 1,985 pages. Price, $8.50.

Compiled by chemists for chemists, this ninth edition offers for the first time sections on physical properties of the earth and its atmosphere; the physical and chemical properties of plastics as materials of construction; the composition and physical properties of plain carbon, low-alloy steels, non-ferrous alloys and sodium-potassium alloys; solders and fluxes; polarography; activity coefficients of ions in water; efficiency of drying agents; specific heat standards; luminescence; fundamental constants for physical chemistry; a viscosity-comparison chart; and a comparison of hydrometer scales. Numerous other sections have been completely rewritten.

More than half of the contents covers the physical and chemical properties of classified substances, the breakdown covering the following general heads: elements, minerals, inorganic compounds, organic compounds, industrial materials, and chemical analysis. Miscellaneous tables of specific properties, tradenames, solubility, density, thermal properties, electrical properties, refractivity, and vapor pressure are given. Included also are nearly 200 pages of conversion factors and numerical tables.

"Evaluation of Polyester Film-Laminated Greaseproof Barrier Materials." H. M. Weiner and M. E. Gigliotti, Picatinny Arsenal, U. S. Army. Order PB 121348 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 12 pages. Price, 50¢.

Two laminated polyester film constructions were evaluated on greaseproof materials. The Grade A barrier material complied with all military specifications except moisture content, and the Grade C material had excellent properties except for the delamination of scrim during flexing at 20° F. With the latter material, springback was excessive. Polyester film laminates show considerable promise as military greaseproof-barrier materials if low temperature flexible waxes for Grade C constructions are used during lamination.

Abstracts of Important Articles

Materials

"Expanded Polyurethane," F. Mancini, *Poliplasti*, 4, 15, 15 (May-June 1956).

After an introductory review of the chemistry of polymerization, polycondensation, and polyaddition, Moltoprene expanded polyurethane material is discussed. The different types of Moltoprene are described, chemical, physical, and mechanical properties discussed, and applications indicated. Tables give data on electrical properties, thermal conductivity, sound insulation, resistance to compression, elastic recovery, and behavior when exposed for one year. (In Italian.)

"Polyvinyl Chloride. II. Industrial Preparation in Suspension," L. Bologna, *Poliplasti*, 4, 15, 7 (May-June 1956).

The suspension polymerization of polyvinyl chloride on an industrial scale is reviewed. Starting with the basic elements of the formula, the author discusses the monomer, various types of catalysts, stabilizers, suspension agents, etc., and how they act. Next, the equipment, factory layout, and working of the plant are dealt with. American patents are mainly referred to, but British, French, and German methods also are mentioned. (In Italian.)

"Cellular PVC," S. E. Bolam and M. S. Welling, *Rubber & Plastics Age*, 37, 6, 379 (June 1956).

The two basic kinds of cellular PVC are the closed-cell type (expanded PVC) and the open cell type (including PVC sponge and foam). Details are given of methods for producing and molding closed-cell PVC; the Elastomer Process for PVC foam; and the blowing process for PVC sponge.

"Energy Absorption of Thermoplastic Films during Light and Heat Irradiation," H. H. Haldenwanger and S. Purucker-Nens, *Kunststoffe*, 46, 9, 407 (Sept. 1956).

Accurate information on the absorption and emission of energy by irradiated plastic films would facilitate predictions on the behavior of materials under various conditions of manufacture and use. Methods and tests are discussed in connection with heating colored films by infra-red radiation; temperature and energy measurements by means of radiation pyrometers; absorption, emission, and transmission of radiation energy by PVC in nine colors under different climatic conditions and on metal ad other surfaces; the prediction of maximum temperatures occurring in materials under various types of irradiation; and the behavior under light and heat radiations produced by bomb explosions. (In German.)

"Magnetic and Nuclear Resonance—Two New Methods for Plastics Research," W. Brugel, *Kunststoffe*, 46, 8, 366 (Aug. 1956).

After discussing in some detail the fundamentals of magnetic nuclear resonance, and nuclear resonance spectroscopy, the author describes two new methods of studying plastics by utilizing this knowledge. Magnetic nuclear resonance has the wider field of application of the two and, in plastics, is used chiefly to determine crystalline and amorphous constituents. It also promises to yield interesting data in connection with investigations on transitions of configurations, and on special "thawing" processes related to temperature. The second method, employing paramagnetic electron resonance, is applied to the study of plastics irradiated with Gamma or other high-energy rays. (In German.)

"An Improved Procedure for Measuring Tensile Modulus and Its Use in Studying the Modulus-Density Relationship for Polyethylene Resins," C. H. Adams and R. H. Supnik, *ASTM Bull.*, No. 217, 70 (Oct. 1956).

An improved technique is described whereby tensile modulus determinations can be obtained with a standard deviation of ±6%. Using this technique, it is shown that modulus is a linear function of density for high-pressure polyethylene resins.

In the reference system used, the first number following the magazine name is the volume number, the second is the issue number (if any), and the third is the first page on which the abstracted article appears in that magazine.

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. A complete listing of the publishers and addresses of these magazines is printed here quarterly.

The next complete listing will appear in March.

"Petrochemistry and Plastics," C. T. Kautter, *Kunststoffe*, 46, 9, 395 (Sept. 1956).

The utilization in the plastics industry of methane, ethylene, propylene, and the various butylenes is discussed, due consideration being given to their availability in Germany and the possibilities of producing them. Developments in petrochemistry in America are constantly referred to, as well as recent advances in West Germany. In 1955, Germany used about 130,000 tons of petroleum products, including refinery gas, for chemical purposes, in addition to 105,000,000 cubic meters of natural gas. (In German.)

"Effects of Foaming Catalysts on Aging of Urethane Foams," Joseph Winkler, *SPE J.*, 12, 11, 23 (Nov. 1956).

Degradation of resilient polyester-urethane foams in service is attributed to temperature and humidity, and is accelerated by the presence of residual alkaline activators used in the foaming process. Properties before and after aging are given for foams made with 12 different activators. A direct relationship has been found between catalyst volatility and aging susceptibility of the foam.

"Control of Chemical and Physical Factors in the Application of Casting Resins," P. L. Nichols, *SPE J.*, 12, 11, 26 (Nov. 1956).

A review of chemical and physical factors indicates that much information is available for control of casting applications. More information is desirable on the kinetics of the basic resin types, the heats of polymerization, accurate heat-transfer calculations, and mechanical and rheological properties of filled systems.

"Flame- and Heat-Resistant Epoxy Resins," P. Robitschek and S. J. Nelson, *Ind. Eng. Chem.*, 48, 10, 1951 (Oct. 1956).

Dicarboxylic acid anhydrides derived from halocyclopentadienes are effective hardeners for epoxy resins. Hardening rate is rapid, and the cured products have high thermal yield points and are fire resistant. The reaction of hexachlorocyclopentadiene and maleic anhydride (as hardener) gives optimum thermal yields. Curing at 180° C. gave castings having an ASTM heat distortion temperature of about 200° C.

"The Effect of Curing Conditions on the Joint Strength of Light Metals Glued with Epoxy Resins," W. Schaller and E. Frischbier, *Plaste u. Kautschuk*, 3, 6, 123 (June 1956).

At the East German Central Institute for Welding, Halle, experiments were conducted to determine the conditions required for maximum strength of light metal assemblies bonded with epoxy resins. The effects of curing temperature and time on tensile shear and flex-peeling strengths were studied on single shear lap-jointed sheets

of an aluminum alloy and pure aluminum bonded with a hot-cure epoxy resin Type AK-1 (similar to Araldite Type I) in the temperature range of 140°-220° C., and with a cold cure type AK-3 at temperatures up to 100° C. In the case of the former resin, the values showed a linear decrease with rising temperature. The values for the cold-cure resin increased with temperature, and hardening time was reduced. Joint strength is influenced by the yield point of the metal which, in turn, determines lap length. A formula for lap length was developed, based on work by K. Frey. (In German.)

"Dielectric Absorption Method of Studying the Structure of Plastics," H. Benoit, *Ind. Plastiques Mod.*, 8, 7, 34 (July-Aug. 1956).

The material is presented in three parts: (1) exposition of the laws of dielectric absorption and the Debye and Eyring theories as basic to proper understanding of experimental results; (2) dielectric behaviour of polymers in solution; and (3) study of polymers in the solid state, in which the influence of various parameters is considered in order to show how results are evaluated. In the latter connection are considered the effect of mass, position and value of dipoles in the chain, effect of plasticizers, fillers, and crystallization, and, finally, the mechanical and dielectric properties.

"A Study of Rheological Testing of Elastomers at Low Temperatures," C. K. Chatten, W. E. Scoville, Jr., and F. S. Conant, *ASTM Bull.*, No. 217, 47 (Oct. 1956).

Results of an investigation of nine types of rheological tests for creep, stress relaxation and recovery, and set. Data are given for various plastics and rubbers.

"Infra-Red Spectrum Analysis of Mixtures of Plasticizers in PVC," N. E. M. Hagethorn and J. P. I. van Kesteren, *Plastica*, 9, 8, 448 (Aug. 1956).

In recent years, infra-red spectroscopy has been found a valuable aid in identifying mixtures of plasticizers in PVC compounds. At the Netherlands Cable Factory, Delft, a procedure was developed by which ultra-violet and infra-red spectra were measured and much more information was obtainable. In various instances, components other than polymers and plasticizers could be identified by infra-red spectra by applying the potassium bromide technique. The authors show that neither infrared nor ultra-violet spectroscopy alone offers the possibilities of a combination of the two. (In Dutch.)

"Investigations on the Impact Strength of Polyesters," H. Hogberg, *Kunststoffe*, 46, 8, 350 (Aug. 1956).

Tests by the Charpy method were carried out on four types of polystyrene; standard (transparent), high-molecular (milk white), high-impact (white), and acrylonitrilestyrene MP (gray), all in the form of injected molded bars. To obtain the most isotropic samples possible (uniform in quality and with properties which do not change in the course of time), the following injection molding conditions should be selected: constant high cylinder temperature; a short plunger forward time; high pressure; and mold design permitting rapid filling of the mold, relatively high mold temperature, and pin-point gating. Injection molded samples have the disadvantage in Izod or Charpy tests that fracture occurs transverse to the direction of flow, giving values of only secondary importance. Hence, it is suggested that samples be prepared from an injection molded part by machining so as to obtain some in which the flow direction is longitudinal, and others in which it is transverse. (In German.)

"Elevated Temperature Properties of Reinforced Plastics," I. Katz and J. Goldberg, *Materials & Methods*, 44, 5, 130 (Nov. 1956).

Data curves are given which permit the comparison of glass-reinforced phenolic, polyester, and silicone laminates at temperatures ranging from 300-1,000° F.

"Moisture Absorption of Thermoplastics," W. Eulitz, *Kunststoffe*, 46, 9, 403 (Sept. 1956).

The dimensional stability of thermoplastic injection moldings may be affected by moisture absorption or swelling to such an extent as to impair their usefulness, particularly in the case of precision parts. A mathematical formula is developed from which a material constant is derived. If this constant is known for a specific material, the formula can be used to determine what amount of water a part made from it, and having a given "specific area" or "surface factor," will absorb in a given time under specified conditions. It is of special importance to the engineer who must decide whether a plastic will meet requirements of design and tolerances. It is suggested that the thermodynamic relationships in injection moldings and, through them, regulation of the production process can be largely controlled with the aid of the surface factor. These relations are to be further elaborated in the future. (In German.)

"Properties and Processing of PVC Suspension Polymerizates," H. Wolff and H. Kronert, *Plaste u. Kautschuk*, 3, 7, 161 (July 1956).

Besides Nubilosa PVC emulsion polymerizate and PVC Marke I, which is low in emulsifier, the Chemische Werke Buna, East Germany, also produces PVC-SP, a suspension polymerizate which is entirely free from emulsifier and electrolyte. It is a fine, free-flowing powder having a particle size 20-200 mu diameter. It can be processed on the same machines as the emulsion types if special precautions are taken. It has mechanical properties like those of Nubilosa and Marke I, but absorbs practically no water in contrast to the other two types, especially Nubilosa. Its electrical properties also are superior to those of the emulsion type materials. Comparative tests on water absorption and electrical properties are described. (In German.)

Processing

"The Bonding of Terylene Polyester Fiber to Natural and Synthetic Polymers," T. J. Meyrick, *Rubber & Plastics Age*, 37, 6, 394 (June 1956).

Methods are described for bonding terylene to natural and synthetic rubbers and to PVC with the di- and tri-isocyanate bonding agents Vulcabond TX and RT. For PVC, the cement includes Vinylite VYNS, dioctylphthalate, solvent, and Vulcabond TX. Depending on the quality of PVC and fabric, bonds of about 10-40 pounds per inch width have been obtained. The effects of compounding ingredients on adhesion, the stability of cements and doughs, and the storage of treated fabric are discussed.

"Injection Molding of a Cellulose Acetate Powder with Good Dimensional Stability," M. Leymarie, *Ind. Plastiques Mod.*, 8, 7, 8 (July-Aug. 1956).

Reference is had specifically to Rhodialite S, cellulose acetate powder, claimed to give moldings with good dimensional stability, especially in hot and humid countries. The author discusses some of the general principles of injection molding, stressing the concepts of "true temperature" and "true pressure" for injection. He shows that for best results, this powder requires an injection temperature above that needed simply to give a smooth, glossy surface. (In French.)

"Continuous Resin Injection for Glass Fiber Molding," J. Rees, *Brit. Plastics*, 29, 8, 294 (Aug. 1956).

The process and equipment for making void-free glass fiber laminates, developed by a British airplane company, are described. The method is a continuous process consisting essentially of injecting a catalyzed resin into a closed, matched mold filled with glass fiber which has been dried by forcing hot air through the die. The catalyzed resin serves to "wash" the fibers to remove air from the mold, and most of this resin is recovered. After these operations, accelerated resin is admitted to the mold. The three operations are synchronized. The manufacture of the molds, production of a typical component, and continuous mass production are considered.

Applications

"Lacquers, Glues and Adhesives," F. Seiter, *Plaste u. Kautschuk*, 3, 1, 5 (Jan. 1956).

The main properties and uses of alkyd resins and stoving lacquers, as well as lacquers, glues, and adhesives based on phenol and urea formaldehyde, cellulose, PVC, acrylics, and butadiene rubber copolymers, are briefly discussed. In each case, the products (usually under their brand names) made by different manufacturers in East Germany are mentioned. (In German.)

"Polyethylene for Packaging Food Products," M. Perraud, *Ind. Plastiques Mod.*, 8, 6, 17 (July-Aug. 1956).

Polyethylene is being used on an increasing scale in France for packaging foodstuffs, either as unsupported film or as coatings for paper, cardboard, aluminum foil, etc. Polyethylene itself is non-toxic, but different ingredients used in its processing may react with foodstuffs. Tables show the reactions of the material to a number of chemicals, food products, oils, greases, solvents, etc. (In French.)

"PVC Pipes for Conveying Mineral Water," M. Simonich, *Poliplasti*, 4, 15, 21 (May-June 1956).

Italy is rich in a variety of natural mineral waters. This article discusses the advantages of an Italian brand of PVC piping for conveying these waters, and gives examples of its use. (In Italian.)

"Adhesive-Bonded Metals in Machine Construction," H. Kretzschmer, *Plaste u. Kautschuk*, 3, 6, 127 (June 1956).

Epoxy and PVA resin cements were examined for use in such assemblies as bolts in bore holes and pins, plugs and the like in rings, and in machines for conditions where dynamic stresses and temperatures are low, as in the textile, food-stuffs and packaging industries. (In German.)

"The Use of Epoxy Casting Resins and Glues in Precision Work and Optics," K. Maasz, *Plaste u. Kautschuk*, 3, 6, 130 (June 1956).

The author describes some of the simple applications of epoxy casting and bonding resins developed by the VEB Carl Zeiss works of Jena, among others: embedding of metal parts, minerals, etc., for microscopic examinations; the assembly of a casing consisting of three light metal sections treated by the Eloxal process; and the bonding of threaded steel pins in metal bushings and in a flanged nut of chromium-plated brass. (In German.)

"Improving Paper and Cardboard for Packaging Purposes with Plastics," F. Ohl, *Kunststoff-Rundschau*, 3, 5, 157 (May 1956).

The important plastics for coating or treating paper and pasteboard to improve their properties for packaging are polyethylene and PVC. Recent developments in the United States and Europe are discussed, including the coating of cellophane with polyethylene and the production of PVC films. The author points out that the German polyvinylidene chloride-based dispersions now available for treating paper give results which, in several respects, are superior to saran film. They are claimed to be resistant to chemicals, oils, fats, and water; are impermeable to water vapor and gases to a great degree; and are easily heat-sealed. (In German.)

"Silicone Finishes for Textiles," A. Richard, *Ind. Plastiques Mod.*, 8, 6, 11 (June 1956).

Besides rendering textiles water-repellent, silicone finishes increase resistance to creasing, staining and abrasion, improve the "handle" of synthetic and artificial fiber fabrics, and facilitate sewing on high-speed industrial machines by reducing frictional heating of the needles. The author explains the chemical constitution and preparation of silicones, and provides several tables to show the effect of increased proportions of silicones on crease recovery, flexing, abrasion, resistance to tearing, and machine sewing efficiency. (In French.)

"Cementing Glass Panes in Molded Plastic Casings," W. Jahns, *Plaste u. Kautschuk*, 3, 6, 132 (June 1956).

Epoxy resins can be employed for setting glass panes in molded plastic casings, recent tests showed. A medium viscosity, cold-cure resin applied to the cut edge of the glass has withstood shaking tests with temperature alternations between –20 and +40° C. for four months, and aging tests for six months. Tests under tropical conditions suggested that a casing made of plastic with low water absorption and glass panes fixed with epoxy resin cement will serve satisfactorily in the tropics. (In German.)

"Printed Circuits," H. Debroise, *Ind. Plastiques Mod.*, 8, 7, 4 (July-Aug. 1956).

Review of manufacturing processes for printed circuits, based chiefly on American methods. Mechanical and electrical characteristics of supporting insulations are considered, as well as costs, applications, and possibilities. (In French.)

General

"Accidents in Industry Caused by Electrostatic Charges and Practical Preventative Measures," Haase and Meyer, *Gummi u. Asbest*, 9, 7, 388 (July 1956).

After discussing how static charges originate and the damage they cause, the authors cite some typical cases in the rubber and plastics industries, and explain how accidents can be prevented. The importance of measuring the static electricity in the shop is stressed, and two devices for this purpose are mentioned. (In German.)

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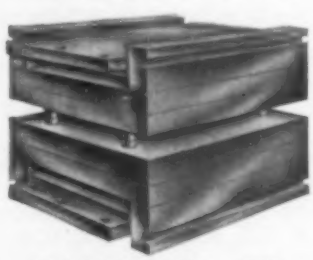

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Patent Digest

Materials

Apparatus for Heating a Thermoplastic Web and Feeding It to an Embossing Means. No. 2,753,591. Cyril J. Stavens, West Springfield, and Stuart Butler, Holyoke, Mass. (to B. F. Perkins & Sons, Inc., Holyoke, Mass.).

This apparatus for use in embossing a continuous web of self-supporting, stretchable plastic material comprises an endless, flexible web-carrying band; a plurality of web-supporting rolls; a heating means; a first and second rigid support for the web-supporting portion of the band; a plurality of guide rolls; and various spreader rolls.

Process and Apparatus for Continuous Drying, Washing, and Cutting of Vinyl Sheeting. No. 2,753,592. Carl J. Cochran, New Kensington, Pa. (to Pittsburgh Plate Glass Co., Allegheny County, Pa.).

The apparatus comprises a feed-in mechanism, a drying chamber, a first cooling chamber, a variable-speed drive mechanism, a tension-regulating means, a washer for said web, a liquid-stripping mechanism, a second conveyor means, a heating means, an air jet, a third conveyor, and a chilling means for setting the web.

Composition Comprising a Gelling Agent and a Dispersion of a Vinyl Resin in a Plasticizer. No. 2,753,314. Edward T. Severs, Mount Lebanon, and Arthur C. Frechtling, Allison Park, Pa. (to Union Carbide & Carbon Corp., New York, N. Y.).

A putty-like composition which can be formed at room temperature comprises 100 parts by weight of an emulsion-polymerized vinyl chloride polymer dispersed in 35-300 parts by weight of a high-boiling liquid plasticizer. This composition is made thixotropic by the addition of at least one organophilic gelling agent such as an amine adduct of bentonite, a silica aerogel, and aluminum di-stearate.

Polyacrylonitrile Solutions Containing Gelation Inhibitors. No. 2,753,320. Karl Glenn Siedschlag, Jr., Waynesboro, Va. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

Acrylonitrile polymer solutions containing at least 85% acrylinitrile by weight are prevented from gelling under heat by the addition of 0.2-2.5% by weight of an aldehyde, ketone, sulfone, ester, or sulfonate.

Dissolution and Purification of Polyethylene Terephthalate. No. 2,762,788. Erhard Siggel, Kleinwallstadt, and Johannes Kleine, Munich, Germany.

The polyester is dissolved in a diphenyl ether, naphthalene, benzophenone, or diphenylmethane at a temperature of 160-240° C., and cooled slowly to obtain a pure precipitate. This is washed in a low-boiling organic liquid for removal of the low boiling fractions of the polycondensate.

Polyesters. No. 2,762,789. James Wotherspoon Fisher, Spondon, near Derby, and James Lincoln, London, England (to Celanese Corp. of America, New York, N. Y.).

This linear polyester is the condensation product of an aromatic dicarboxylic acid and a bis-(beta-hydroxy-ethoxy) aromatic compound, whose two hydroxy-ethoxy groups are joined solely through nuclear aromatic carbon atoms.

Ethylene Polymerization. No. 2,762,791. Donald C. Pease and Milton J. Roedel, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

Ethylene is cooled to a temperature which is at least as low as its critical temperature, and at a pressure sufficient to render it liquid. It is then polymerized in the liquid phase to produce solid homopolymers.

Process for the Preparation of Copolymers from Linseed Oil and Styrene, and the Copolymers Thus Prepared. No. 2,761,850. Willem Johan Taat, Delft, Netherlands (to Naamloze Vennootschap Scado Kunstharsindustrie, Zwolle, Netherlands).

Linseed oil is copolymerized with styrene to form clear polymers which dry to clear films. The oil is heated above 200° C., with 0.05-0.2% by weight of selenium, prior to polymerization.

Method of Coupling Styrene with Alkyl Aromatics. No. 2,761,886. Charles E. Frank, Cincinnati, O., and James S. Swinehart, Brooklyn, N. Y. (to National Distillers Products Corp., New York, N. Y.).

Alkyl aromatics containing dispersed alkali metal in the form of suspended droplets is maintained at a temperature of 60-200° C., and styrene is added at a rate of 0.25 mole per hour, per mole of alkali metal present in the reacting mixture.

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Price, 25c each.
—The Editor

Equipment

Apparatus for Forming, Filling, and Sealing Plastic Containers. No. 2,761,264. Fred C. Gossett, Glendale, Calif. (to Don Baxter, Inc., Glendale, Calif.).

The apparatus comprises a means for advancing flexible tubing from a reel, a means for inflating a portion of the tubing as it is advanced, a shoe over which the inflated tubing travels, a means for slitting the expanded tubing, a means for sealing this slit, an inlet section attached to the shoe through the slit, and a means for introducing solution into the advancing tubing.

Material Removing Device for Molding Apparatus. No. 2,763,026. Harry H. Holly, Chicago, Ill. (to Hollymatic Corp., Chicago, Ill.).

The apparatus comprises a means, adjacent to the opening, for dislodging the piece; a means for preventing air flow through the aforementioned means during approach; and a means for venting air through it upon establishment of contact.

Molding Apparatus. No. 2,763,028. Ralph A. Blake, Milford, Conn. (to United States Rubber Co., New York, N. Y.).

The side and bottom walls of the mold define the mold cavity, whose opening is defined by the top rim of the walls. The bottom has a vent adapted to discharge gas from the cavity before the charge reaches it. Resilient, flowable material in the bottom wall is adapted to close this vent upon transmission of molding pressure from the charge.

Processing

Process for the Production of Acrylonitrile Polymer Fibers. No. 2,761,754. Wilford Donald Jones, Summit, and Charles E. Kaufman, Jr., Montclair, N. J. (to Celanese Corp. of America, New York, N. Y.).

A solution of 85% acrylonitrile in a water-miscible solvent is extruded in the form of a filament through an evaporating zone. The evaporation phase has two steps, which involves aqueous wetting between evaporations for hardening purposes. This prevents substantial lengthwise contraction.

Method of Injection Molding around a Plurality of Inserts. No. 2,763,032. Howard G. Fay, Rochester, N. Y. (to United States of America, as represented by the Secretary of the Navy).

A stack of axially-aligned, apertured, thin, flat members are assembled on a mandrel. Their apertures are completely

filled, and they are clamped axially between a pair of clamping members. The mandrel is then placed centrally in a mold cavity, and molding material is introduced under pressure from a single gate opposite one of the clamping members. The axis of this gate should be in alignment with the mandrel axis. This forms an insulating jacket around the outer periphery of the stack.

Applications

Flexible Containers. No. 2,754,866. Bertram W. Coltman, Jr., Kenilworth, Ill. (to Republic Molding Corp., Chicago, Ill.).

The container and snap-type cover are formed of polyethylene or similar, flexible plastic substances. An outwardly-overhanging bead is formed at the rim of the wall body, and fits into a recess on the cover. Flexing said cover increases the pressure on the bead, thus preventing the cover from being displaced.

Dental Prostheses, Jaw-Splints, and Jacket-Crowns. No. 2,755,552. Paul Brandau, Lubbecke, Germany (to Union Broach Co., New York, N. Y.).

The dental appliance consists essentially of a polyamide base with an imbedded reinforcement filler made of polyamide threads.

Hollow Plastic Clogs. No. 2,755,567. Ruth L. Rudine, Miami Beach, Fla.

The shoe comprises a plurality of sections shaped from transparent plastic sheets. These include an inner sole, an outer sole, a heel section, spacer web, heel lift, and toe strap.

Laminated Fibrous Glass Material. No. 2,762,735. Jesse Werner, Holliswood, N. Y., and Robert Steckler, Russell, O. (to General Aniline & Film Corp., New York, N. Y.).

The laminated article comprises sheets of fibrous glass material bonded together with a copolymer of n-vinyl pyrrolidone and an allyl ester of a dibasic carboxylic acid, copolymer proportions being in the weight ratio of 5-20%:80-95%, respectively.

Method and Composition for the Production of Speckled Plastic Ware. No. 2,761,176. Kenneth B. Welch and Roger R. Sacia, West Bend, Wis. (to Kenro Corp., Fredonia, Wis.).

A thermosetting plastic base material is crushed and admixed with thermosetting granules of 20-120 mesh in a different color. Base material and additive should have different degrees of curing.

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Flat	ton	25.00	
PD-10	ton	49.00	
PD-121	ton	20.00	
PX	ton	41.00	
Harwick fillers:			
Walnut shell flours:			
100W, 200WD	ton	50.00	/ 60.00
200W	ton	60.00	/ 70.00
200WB	ton	62.00	/ 72.00
325W	ton	74.00	/ 84.00
Lubricant			
Lubrex	lb.	.27	/ .32
Plasticizers			
Barrett dibutyl phthalate	lb.	.30	/ .335
Dimethyl phthalate	lb.	.28	/ .315
Plasticizer 136	lb.	.175	/ .21
Columbian Carbon butyl stearate	lb.	.2325	/ .3225
Dibenzyl sebacate	lb.	.92	/ 1.01
Dihexyl sebacate	lb.	.67	/ .76
Diisodecyl phthalate	lb.	.295	/ .39
Diisooctyl phthalate, dioctyl phthalate	lb.	.28	/ .375
Dimethyl sebacate	lb.	1.30	/ 1.39
Sebacic acid, CP	lb.	.75	/ .87
Purified	lb.	.69	/ .81
Elastex 10-P, 28-P	lb.	.28	/ .315
18-P	lb.	.285	/ .32
DCHP, cast solid	lb.	.58	/ .59
Granular	lb.	.595	/ .605
Kessco flex BCL	lb.	.365	/ .375
BCO	lb.	.355	/ .365
BCS	lb.	.305	/ .315
BS	lb.	.235	/ .26
DBT	lb.	.64	
DDA, DIOA, DOA	lb.	.40	/ .435
DOZ	lb.	.46	/ .50
MCO	lb.	.3225	/ .3525
MCP	lb.	.37	/ .40
MCS	lb.	.33	/ .34
ODA	lb.	.47	/ .50
Kronitex AA, I, K-3, MX	lb.	.325	/ .36

CALENDAR of COMING EVENTS

February 20
SPE New York Section. Governor Clinton Hotel, New York, N. Y.

February 21
SPE Eastern New England Section. Hotel Beaconsfield, Boston, Mass.

SPE Pittsburgh Section. Cappy's Restaurant, Pittsburgh, Pa.

February 26
SPE Central Indiana Section. Warren Hotel, Indianapolis, Ind.

SPE Philadelphia Section. Franklin Institute, Philadelphia, Pa.

February 27
SPE Quebec Section. Queen's Hotel, Montreal, Que.

Reinforced Plastic Group, SPE New York Section. Tufaro's Restaurant, Corona (Queens).

February 27-March 1
ASTM Committee D-20 on Plastics. Roanoke Hotel, Roanoke, Va.

March 5
SPE Kansas City Section. Milleman's Restaurant, Kansas City, Mo.

March 6
SPE Western New England Section. Bradley Field, Windsor Locks, Conn.

March 7
SPE Southern California Section. Scully's Restaurant, Los Angeles, Calif.

March 11
SPE Cleveland-Akron Section. Spanish Tavern, Brecksville, O.

March 12
SPE Baltimore-Washington Section. Langley Park Hot Shoppe, Takoma Park, Md.

SPE Milwaukee Section. Bavarian Club, Milwaukee, Wis.

March 13
SPE Newark Section. Military Park Hotel, Newark, N. J.

March 18-21
Pacific Coast Plastics Exposition. Shrine Exposition Hall, Los Angeles, Calif.

SPI Annual National Conference. Hotel Biltmore, Los Angeles, Calif.

March 27
ASTE Plastic Tooling Symposium. Shamrock-Hilton Hotel, Houston, Tex.

April 3
SPE New York Section. Regional Technical Conference. Plastics for Building. Hotel Statler, New York City.

April 4-5
SPI of Canada. Annual Conference, Ottawa, Ont.

July 10-20
British International Plastics Exhibition. Grand & National Halls, Olympia, London, England.

Domestic Production and Sales of Plastics and Resin Material, September and October, 1956

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of September and October, 1956. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

Most materials show gains, both in production and sales. Exceptions are Coumarone-Indene resins and, surprisingly, polyethylenes. This marks the first month in which vinyl sales have reached the 70-million mark. Over-all production and sales show a 15–20% increase over previous-month's figures.

	September		October	
Cellulose Plastics:[1]	Production	Sales	Production	Sales
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,882,989	1,833,050	1,539,399	1,504,625
Sheets, 0.003 gage and over	1,502,804	1,449,587	1,621,409	1,633,022
All other sheets, rods, and tubes	559,279	544,252	675,846	586,023
Molding and extrusion materials	8,578,843	7,888,442	9,390,246	9,574,996
Nitrocellulose sheets, rods, and tubes	324,031	354,412	395,878	378,579
Other cellulose plastics	278,760	243,628	563,509	545,968
TOTAL	13,126,706	12,313,371	14,186,287	14,223,213
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	15,771,397	13,916,800	17,971,498	16,433,338
Bonding and adhesive resins for—				
Laminating (except plywood)	5,731,691	4,359,199	5,929,989	4,409,565
Coated and bonded abrasives	1,093,466	1,049,778	1,450,098	1,652,323
Friction materials (brake linings, clutch facings, and similar materials)[7]				
Thermal insulation (fiber glass, rock wool)	4,084,211	4,181,296	5,063,153	4,849,969
Plywood	3,880,554	2,838,631	3,807,866	3,191,989
All other bonding and adhesive uses	4,132,506	3,983,703	5,150,273	5,161,433
Protective-coating resins, unmodified and modified except by rosin	2,175,912	1,966,734	2,710,870	2,070,216
Resins for all other uses	2,904,106	2,782,738	4,120,513	3,317,453
TOTAL	39,773,843	35,078,879	46,204,260	41,086,286
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	2,293,566	2,647,683	3,442,454	3,577,083
Paper-treating and paper-coating resins	2,199,572	1,769,175	2,215,736	2,034,785
Bonding and adhesive resins for—				
Plywood	7,858,671	7,764,104	9,077,073	8,411,834
All other bonding and adhesive uses, including laminating	1,826,474	1,842,553	2,437,456	2,508,495
Protective-coating resins, straight and modified	2,951,392	2,372,678	3,481,430	2,888,943
Resins for all other uses, including molding	7,581,213	7,179,152	8,518,274	8,348,220
TOTAL	24,710,888	23,575,345	29,172,423	27,769,360
Styrene Resins:				
Molding materials[1]	37,283,849	30,704,246	37,734,570	35,035,188
Protective-coating resins, straight and modified	6,736,933	7,200,149	8,109,563	7,434,330
Resins for all other uses	7,030,312	7,498,913	11,054,362	11,831,623
TOTAL	51,051,094	45,403,308	56,898,495	54,301,141
Vinyl and Vinyl Chloride Resins:[3]				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		7,159,349		8,580,620
Sheeting (resin content)		4,194,099		5,340,865
Molding and extrusion (resin content)		17,227,794		21,339,191
Textile and paper treating and coating (resin content)[8]		5,197,682		6,383,987
Flooring (resin content)		5,525,601		6,790,318
Protective coatings (resin content)		2,025,157		2,568,370
All other uses (resin content)		5,945,170		5,984,158
All other vinyl resins for—				
Adhesives (resin content)		2,892,694		3,231,161
All other uses (resin content)		9,290,606		10,773,464
TOTAL	60,236,772	59,458,152	67,176,069	70,992,134
Coumarone-Indene and Petroleum Polymer Resins	20,512,939	20,537,902	21,444,326	21,970,723
Polyester Resins	5,368,906	4,601,731	6,472,584	6,168,727
Polyethylene Resins	51,089,205	40,056,029	49,109,880	45,783,014
Miscellaneous Synthetic Plastics and Resin Materials:				
Molding materials[1], [4]	3,468,300	3,795,576	3,916,515	4,348,917
Protective-coating resins[5]	1,026,478	560,946	1,114,826	509,732
Resins for all other uses[6]	9,829,632	8,488,874	9,446,126	9,644,882
TOTAL	14,324,410	12,845,396	14,477,467	14,503,531
GRAND TOTALS	280,194,763	253,870,113	305,141,791	296,798,129

[1]Includes fillers, plasticizers, and extenders.
[2]Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3]Includes data for spreader and calendering-type resins.
[4]Includes data for acrylic, nylon, silicone, and other molding materials.
[5]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins.
[6]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.
[7]Included with "All other bonding and adhesive uses."
SOURCE: United States Tariff Commission, Chemical Division.

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